EXPLORER SOLUTIONS

Final Report

Air Services and Fleet Strategy

Presented to

Royal Canadian Mounted Police (RCMP)
Air Services Branch (ASB)

July 29th, 2016

Founded in 1995

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1 Executive Summary

This mandate was completed in accordance with RCMP Contract No 201602033B dated March 17, 2016.

This mandate has been conducted keeping in mind that ASB needed to remain:

a. Relevant - it is critical that the ASB remains aligned with overall RCMP strategy to meet current and future requirements;
b. Responsive - establish a structure and modus operandi that ensures optimal operational readiness based on defined goals and measurable results;
c. Compliant - maintain full compliance with CAR604 requirements and ensure that the Quality Assurance program is followed and updated as required;
d. Competent - diligent approach to competency training for all ASB personnel including pilots, AMEs, Flight Coordinators and management personnel. Regular benchmarking against similar operations and review of best practices will optimize professionalism;
e. Flexible - the purpose of ASB is to provide operational services to RCMP Law Enforcement roles and missions. Understanding user needs and identifying optimal ways to meet requirements will require flexibility in employment and innovation in approaches and technology (e.g. future use of UAVs);
f. Responsible - safety remains paramount for its employees, its clients and towards the public. This also includes the need to ensure the proper tools are provided to perform the required duties of all personnel; and
g. Accountable - ASB is accountable to the RCMP leadership, to Transport Canada and ultimately to the general public. The establishment of measurable goals and processes to appropriately measure the results will give credibility to the organization.

These are required elements for Air Services Branch to continue to be of value to RCMP operations while ensuring personnel are provided the right tools to carry out their day-to-day duties.

ASB is composed of very professional men and women dedicated to meeting the demands of the Divisions. This needs to be performed in a more structured and holistic fashion. Currently, ASB operates as a series of independent units scattered across the country, doing their best for their Division but are very concerned that their individual methods fulfil their needs better than the available tools can. This is partially a result of being provided with tools and systems that are very much antiquated or not having any altogether.

The RCMP would benefit immensely from a strong centralized approach that would have clear performance mandates, with a wide oversight to respond to the more pressing needs and the tools to perform the work.

Throughout the course of this study, an assessment of the needs and demands of the RCMP in terms of air support was performed through a review of documentation, a review of existing data, and interviews with personnel at various levels throughout the ASB and RCMP organization. The analysis was performed from the input collected from all of these sources but also through the examination of commercial and similar organizations to understand the industry's best practices and how they could apply to ASB.

There were 16 findings and 20 recommendations made. They are found in section 18 of the report. Here are the highlights of the findings and recommendations:

- The RCMP needs to provide a Statement of Performance and Requirements for the delivery of Airborne Law Enforcement as a first step to improve overall performance;
- ASB needs to play a more important role in the daily operations of its Air Sections;
- ASB needs to develop the right performance metrics that will allow for a better analysis of needs and demands;
- The aircraft presently being used are for the most part appropriate to perform the majority of their assigned tasks. Changing for bigger and faster aircraft may not make economic sense;
- Based on the information available there are no clear aircraft replacement cycles that can be established but recommendations are made based on a number of facts;
- There should a centralization of flight coordination for better oversight;
- A global strategy is required for the performance of maintenance in a more effective manner, hence reducing downtime and improving dispatch reliability;
- It is suggested that a number of units be closed and amalgamated with nearby units within the same Division for increased synergy and efficiencies.

2 Introduction

In 2013, the RCMP Air Services Branch (ASB) was subjected to a Transport Canada Advisory Assessment where a number of observations were raised. As a result, RCMP ASB leadership performed a "Flight Operations Evaluation" which was concluded in January 2015. The evaluation made six (6) recommendations ranging from governance, financial management and the need for gathering the right information to support effective management of ASB assets.

In response to the Flight Operations Evaluation, ASB leadership initiated the development of a response document identifying a number of steps that the Branch would take to become more responsive with a structure that would be more accountable for the actions of its members which was documented, this was the Management Response and Action Plan (MRAP) (Reference B). Specifically, Recommendation 6: *"Air Services Branch must develop and implement a national strategic plan that will establish a national picture of how the aircraft are used. Such information will help support sound decision-making regarding aircraft placement and when aircraft can be shared for emerging short and long term operational priorities, and the human and financial resources*."

Over the past three (3) years, the leadership at ASB has worked diligently at implementing the various facets of the MRAP. Consequently, following consultation with its members through a strategic planning workshop held in Ottawa on December 8th and 9th, 2015, the RCMP Air Services Branch (ASB) prepared an ASB Strategic Plan for 2016 to 2020, which was released in draft on February 8th, 2016 (Reference D).

In the strategic plan, the Director General ASB introduced the various elements required to have in place to ensure vital Airborne Law Enforcement (ALE) capabilities for the 21st century. To note, this was the first time the term ALE was introduced to the RCMP vocabulary as an organizational entity.

This reflects well the RCMP ASB's mandate and is also in line with other similar worldwide organizations.

In pursuing its desire to have a highly effective, efficient and accountable Airborne Law Enforcement Capability, the RCMP has mandated Explorer Solutions to address one of the identified elements of the MRAP and perform a study on the adequacy of the air assets currently being used by the RCMP and to provide advice on their management.

3 Mandate Objectives

The current mandate was performed under contract No 201602033B – Air Services Strategic Plan.

The purpose of this RCMP Air Services Fleet Strategic Plan is to outline, in a formalized manner, the strategy for the "ever-greening" and effective delivery of the Air Services aircraft fleet assets while advising the RCMP as to the right projected mix of multi-role, short, medium and long-haul air platforms to fulfill the RCMP's operational policing law enforcement requirements as Canada's national police service.

The purpose is to review the composition of the air fleet currently in use by the RCMP, to validate that the RCMP has the optimum mix of aircraft to perform the work and provide advice on the management of the assets.

In summary, the objectives are to:

- Review user needs assessment and demand analysis;
- Determine optimal platforms to meet the need;
- Determine optimal replacement schedules for each aircraft type;
- Determine the most effective and efficient structure for delivery of air operations; and
- Develop performance metrics for air operations.

4 Abbreviations

A/C (a/c)	Aircraft
ADS-B	Automatic Dependent Surveillance - Broadcast
AHE	Airspeed Height Envelope
ALE	Airborne Law Enforcement
AME	Aircraft Maintenance Engineer
ASB	Air Services Branch
CAR	Canadian Aviation Regulations
CCP	Corrosion Control Program
CIP	Critical Incident Package
CROP	Criminal Operation
C/Supt	Chief Superintendent
DAR	Design Approval Representative
DBA	Decibels
DI	Daily Inspection
EDU	Explosives Disposal Unit
EO	Electro-Optic
EPA	Environmental Protection Agency
ERT	Emergency Response Team
FAA	Federal Aviation Administration
FM	Flight Manual
FW	Fixed Wing Aircraft
GAG	Ground-Air-Ground
HAS	High Altitude Surveillance
HASP	High Altitude Surveillance Program
HETS	Human External Transportation Systems
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IR	Infrared
ISR	Intelligence, Surveillance and Intelligence
LEP	Life Extension Program
LOE	Level of Effort
MAM	Material and Assets Management
MRAP	Management Response and Action Plan
OEM	Original Equipment Manufacturer
OPSIC	Office of the Public Sector Integrity Commissioner
PAFI	Piston Aviation Fuel Initiative

PCC	Pilot Competency Check
PFM	Performance Flight Management
R&D	Research and Development
RCMP	Royal Canadian Mounted Police
RNAV	Area Navigation
RNP	Required Navigation Performance
RW	Rotary Wing Aircraft
SMS	Safety management System
SOP	Standard Operating Procedures
SOR	Statement of Requirements
TBO	Time Between Overhaul
TC	Transport Canada
TCCA	Transport Canada Civil Authorities
TFO	Technical Flight Officer
TSB	Transportation Safety Board
TSO	Time Since Overhaul
UAS	Unmanned Aerial Systems
VFR	Visual Flight Rules

5 Background and Context

The RCMP ASB will celebrate its 80th anniversary in 2017. It was first established in Moncton with four twin engine bi-planes. Over time, aircraft were considered valuable assets to support law enforcement activities and as policing needs grew, the force increased the number of flying assets. Following the events of September 2001, the fleet had a significant increase of 14 aircraft. It has long been recognized that Air Assets are a police force multiplier, not only in Canada but across the globe, and as such there has been an increased emphasis on integrated and international policing to ensure domestic and continental security.

The RCMP is responsible for performing federal policing mandates in Ontario and Quebec while it provides contracted as well as federal policing services to the eight other provinces and the three (3) territories. As part of the ASB Strategic Plan for 2016-2020 (Reference D), the Air Services Branch (ASB) is currently being rebranded as Airborne Law Enforcement (ALE). This better reflects the role ASB is playing as an integral part of Law Enforcement activities performed by the RCMP and it is also in line with international practices.
The rebranding further highlights the operational element of its role as a force enabler/multiplier to ground forces. ASB reports directly to the Assistant Commissioner for Technical Operations which in turn reports to the Deputy Commissioner for Specialized Policing Services.

In summary, the RCMP's Air Services provides direct operational support in technical and specialized areas of ALE enabling front-line members to preserve the peace, uphold the law and prevent and investigate crime.

5.1 Fleet Composition

Over the years, the number of aircraft in the fleet fluctuated and two (2) years ago, the fleet stood at 41 aircraft. As a result of budget reductions of the recent years, the RCMP has had to rationalize its fleet. Today, the fleet is composed of a total of 34 aircraft that are located at 19 locations across the country as presented in **Annex A**.

As a result of the reduction of aircraft and personnel, it has been necessary to re-allocate assets in an effort to continue to effectively and efficiently respond to operational demands and make optimum use of the human resources available.

The fleet consists of the following aircraft:

a. Fixed Wing Aircraft
   - 3 Cessna 208 (Caravan);
   - 5 Cessna 206 (Stationair);
   - 1 De Havilland DHC-6 Series 3 (Twin Otter);
   - 1 Quest Kodiak 100;
   - 3 Pilatus PC-12/45;
   - 1 Pilatus PC-12/47; and
   - 12 Pilatus PC-12/47E

b. Rotary Wing Aircraft
   - 6 Airbus AS350 B3 (ASTAR); and
   - 2 Airbus EC120B (COLIBRI).

5.2 RCMP Air Services Role and Mandate

The Royal Canadian Mounted Police (RCMP) Air Services encompasses 19 air sections, with a physical presence in eight (8) provinces and three (3) territories. Assets in Moncton (J Division) are also used to support Law Enforcement in Nova Scotia (H Division), PEI (L Division) and Newfoundland (B Division). The location of the Air Services Bases allows the RCMP to provide specialized Airborne Law Enforcement capabilities enabling operational policing success in all provinces and territories.

Specifically, ASB is involved in the following operations:

a. Prisoner, Witness, Evidence and Supplies Transport;
b. Integrated cross-border law enforcement operations (Air rider);
c. Surveillance and Search and Rescue Capabilities;

d. ERT and Tactical Troop Assistance;
e. Operational Personnel Transport and Assistance;
f. Border Security;
g. Aerial Security for Major Events;
h. Urban Patrols;
i. National Security and Community Safety;
j. VIP Transport; and
k. Administrative Duties for Reviews and Inspections.

5.3 Airworthiness and Regulatory Context

The RCMP's ASB organization as an operator of aircraft must comply with the Transport Canada Civil Authorities (TCCA) Canadian Aviation Regulations (CARs). ASB operates under the issuance of a Private Operator Registration regulated in Part VI, Subpart 4 of the CARs also known as a 604 certificate. As such, ASB has to ensure its aircraft remain airworthy and that personnel involved in aircraft operations and maintenance are well-trained and qualified to perform the duties assigned to them within the organization. TCCA provides oversight over all Canadian aircraft operations, including ASB, and is responsible to continuing airworthiness requirements of the organization through regular audits.

5.4 Framework for this study

This Air Services and Fleet Strategy falls into the Air Services Branch (ASB) Strategic Plan for 2016 to 2020 (Reference D), which has been devised as a tool to implement the Management Response and Action Plan (MRAP) (Reference B).

Specifically, it is to meet the following stated strategic objectives:

a. Optimize and Enhance Governance, Accountability and Engagement;
b. Comply with Legislative and Regulatory Requirements;
c. Optimize Information Management and Reporting;
d. Fleet and Equipment;
e. Central Asset Tracking, Management and Flight Coordination; and
f. Maintenance.

6 Strategic Planning Methodology

This study was performed following a well-structured Strategic Planning Process in order to determine the best possible options for the RCMP in delivering its Airborne Law Enforcement mission well into the 21st century. In preparation for this study, a number of documents were provided and have been used to support the investigation. A summary of those documents is presented in **Annex B**.

The following provides a high level breakdown of the process:

6.1 Review user needs assessment and demand analysis

a. Review existing documentation;
b. Gather any data available through the RCMP;
c. Establish data requirements;
d. Gather Operational Requirements Data and Concerns (interviews)
    - Policy Centre - Clients and ASB staff;
    - Divisions – Client (CROPs and Line Officers)
    - Air Service Bases - Service providers
    - Other stakeholders
e. Identify Constraints and Restraints
    - Procurement guidelines for the RCMP (hence from Treasury Board)
    - Budgets
    - Personnel

6.2 Determine optimal platforms to meet the needs

a. Develop decision process criteria
    - Operation requirements
    - Expectations
    - Risk (to current operations as perceived by the aircrew)
    - Risk of operating single engine aircraft
    - Risk of operating aging aircraft
    - Mission requirements (endurance, capacity, autonomy, reliability)
    - Environmental considerations as per government policy and guidelines
    - Fleet commonality
    - Equipment commonality
b. Develop potential replacement options based on operational requirements

6.3 Determine optimal replacement schedules for each aircraft type

a. Perform option analysis
    - Include buy versus lease options
    - Include reliability changes with increase flight hours

b. Establish costing model for each option
c. Develop equipment replacement model

6.4 Determine the most effective and efficient structure for delivery of air operations

a. Analyze operational delivery concept
   - Assess delivery effectiveness
   - Assess organizational constraints
   - Assess the role of the Policy Centre
   - Develop potential options
   - Analyze options
   - Propose Model
b. Analyze Maintenance Delivery
   - Review Maintenance Concept
   - Develop Maintenance Options
   - Analyze Maintenance Options
   - Propose Maintenance Concept

6.5 Develop performance metrics for air operations

a. Assess existing performance metrics
b. Determine the metrics that are needed for an effective management of the fleet (understand the health of the various fleet elements and identify the points to be improved)
c. Understand the possibilities with new maintenance software
d. Propose a performance metrics implementation plan

7 Roles and Responsibilities

7.1 Air Services Branch Policy Centre

According to the Commissioner's "Directive on Senior Management Responsibilities, Authorities and Accountability"; NHQ is responsible for managing systemic risk through leadership, strategic direction, priority setting, resource allocation to and between Divisions and overseas, policy and program development, public policy engagement, compliance, evaluation and oversight, coordination and, at times, direct control and delivery of operations and services. Although ASB Policy Centre has full authority to provide input into Divisions' operations, it is not regularly exercised and used in times of emergency. It normally acts as a governance body that ensures each field unit operates within a series of nationally established standards. As such, it is the Technical Authority for Air Services. Through the ASB Director General, the RCMP is accountable to Transport Canada for the airworthiness of the fleet. The policy Centre's role is also to support its units by ensuring the right tools are available for Air Services to deliver its mandate in a safe, effective and efficient manner.

To perform these duties, the ASB has in place a Quality System against which to audit its units for compliance with TCCA's rules and regulations as well as with ASB's standards and procedures.

Specifically, its responsibilities are:

a. Create national standards and policy;
b. Audit units against the established standards;
c. Provide a fixed wing and a rotary wing chief pilot who is responsible to Transport Canada for ensuring training and standards are in place to maintain pilots proficiency;
d. Provide a Director of Maintenance for the fleet who will ensure aircraft are maintained in accordance with Transport Canada's Canadian Airworthiness Regulations (CARs);
e. Manage parts supply for the fleet ensuring traceability and airworthiness;
f. Support the Divisions when staffing positions in ensuring personnel meet the required standards set by the Policy Centre;
g. Put contracts in place to support field units operation and maintenance;
h. Review equipment demands and proceed with procurement as necessary; and
i. Establish a strategic plan for the management of Air Services Branch.

7.2 Corporate Management – Material and Assets Management

Corporate Management – Materiel & Assets Management (MAM) is the financial and administrative functional authority responsible for the development of asset policy, strategic investment planning, coordination and implementation of national fleet initiatives, and management of capital allotted for fleet assets.

As such, MAM has developed a comprehensive policy for fleet assets: the Transport Management Manual. MAM is part of the Internal Services Program Activity and works with ASB to implement the Air Services and Fleet Strategy.

7.3 Air Services Bases

There are 19 Air Services bases located across the country. Each unit has been allocated a number of aircraft that is aimed at satisfying the needs of their mandate in their regions of operation. The list of the various air bases along with their assets and roles is presented in **Annex A**. The list has been rearranged per provinces and cities in Table 1.

Table 1 - Distribution of aircraft per province

Base of operation (Province)	# A/C per province	Base of operation (City)	Common Name	Model Name	Aircraft Main Roles
AB	4	Edmonton	Eurocopter	AS350 B3	SAR, PATROL, VIP,
		Edmonton	Cessna	T206H	
		Edmonton	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER, VIP
		Edmonton	Pilatus	PC-12/45	PAX TRANSPORT, PRISONER, VIP
BC	11	Comox	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER, DRUGS
		Kelowna	Quest	Kodiak 100	PAX TRANSPORT
		Kelowna	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER, DRUGS
		Prince George	Pilatus	PC-12/47	PAX, PRISONER, FLY-IN COMMUNITIES
		Prince George	Eurocopter	AS350 B3	SAR, PATROL, VIP,
		Prince Rupert	Cessna	208	PAX TRANSPORT
		Vancouver	Cessna	U206G	
		Vancouver	Cessna	T206H	
		Vancouver	Eurocopter	EC120B	PATROL LOWER MAINLAND
		Vancouver	Eurocopter	EC120B	PATROL LOWER MAINLAND
		Vancouver	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER

Base of operation (Province)	# A/C per province	Base of operation (City)	Common Name	Model Name	Aircraft Main Roles
MB	3	Thompson	Pilatus	PC-12/47E	PAX TRANSPORT, NORTHERN
		Winnipeg	Pilatus	PC-12/45	PAX TRANSPORT, NORTHERN, PRISONER, RELIEF
		Winnipeg	Pilatus	PC-12/47E	PAX TRANSPORT, NORTHERN, PRISONER, RELIEF
NB	2	Moncton	Eurocopter	AS350 B3	SAR, PATROL, VIP, ERT
		Moncton	Pilatus	PC-12/47E	PAX TRANSPORT BETWEEN 4 DIVISIONS, PRISONER, VIP
NL	1	Goose Bay	DE Havilland	DHC-6 SERIES 300	PAX TRANSPORT, FREIGHT, PRISONER, RELIEF, NORTHERN
NU	1	Iqaluit	Pilatus	PC-12/47E	PAX TRANSPORT, RELIEF, PRISONER, REMOTE NORTHERN, SUPPLIES, FREIGHT
NWT	1	Yellowknife	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER, RELIEF, NORTHERN
ON	4	London	Cessna	T206H	

Base of operation (Province)	# A/C per province	Base of operation (City)	Common Name	Model Name	Aircraft Main Roles
		London	Pilatus	PC-12/47E	SOME PAX TRANSPORT, PRISONER, VIP
		Ottawa	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER, INTERNATIONAL POLICING, EXTRADITION, INVESTIGATIONS
		Ottawa	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER
QC	3	Montreal	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER
		Montreal	Cessna	208B	
		Montreal	Cessna	208B	
SK	3	Prince Albert	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER
		Regina	Cessna	T206H	
		Regina	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER
YT	1	Whitehorse	Pilatus	PC-12/45	PAX TRANSPORT, NORTHERN FLY-IN COMMUNITIES

For each of the bases, the RCMP's assignment of personnel is based on two (2) pilots per aircraft and one (1) AME. In addition, each of the regions, is complemented by one (1) or two (2) flight coordinators who ensure all the requests are processed, and that aircraft are dispatched to serve the needs of the Division. The distribution of personnel in direct support of flight operations is presented in Table 2.

Table 2 - Personnel Distribution

Personnel Distribution Per Location						
Prov	**City**	**# RW aircraft**	**# FW aircraft**	**# AMEs**	**# RW pilots**	**# FW pilots**
AB	Edmonton	1	3	4	3	6
BC	Vancouver (Boundary Bay)	2		3	4	
BC	Vancouver (Langley)		3	1		5
BC	Kelowna	1	1	2	2	2
BC	Prince George	1	1	2	2	2
BC	Prince-Rupert		1	1		2
BC	Comox	1		1	2	
MB	Winnipeg		2	2		4
MB	Thompson		1	1		2
NB	Moncton*	1	1	2	2	3
NFLD	Goose Bay		1	1		2
NU	Iqaluit*		1	1		2
NWT	Yellowknife		1	1		2
ON	Ottawa		2	2	1	4
ON	London*		2	2		3
QC	Montreal	1	2	2	1	5
SK	Regina		2	2		3
SK	Prince Albert		1	1		2
YT	Whitehorse*		1	1		2

An important fact to note is that for the locations mentioned with an asterisk, there is one (1) vacancy for each of those locations, implying that at the time of preparing this report, there was no AME available in Iqaluit and Whitehorse. Also, in addition to AMEs supporting direct aircraft maintenance, there are three (3) avionics AMEs in Ottawa and one (1) in Vancouver.
On the bases involved with surveillance operations, the units are also staffed with a number of Technical Flight Officers (TFO) which are used to operate the mission systems on-board the aircraft. The TFOs fall under the Divisions' hierarchy and are under the umbrella of the C/Supt responsible for Technical Investigation Services and are not the responsibility of ASB. Their role is to provide direct support to police investigations.

Although Air services bases operate under the policy, standards, rules and airworthiness regulations of ASB Policy Centre, they are responsive to the Divisions' Commanding Officers

through the Criminal Operations Officers (CROPs) where air services bases are responsible to respond to front line requirements from the various divisions.

7.4 RCMP Policy Centre

Although it is within their authority, the RCMP Headquarters does not normally provide direct command and control over daily field operations but rather is mainly responsible to provide overall support and policy development and implementation with respect to the various groups within each of the Divisions.
In the case of this study, the groups of interest were:

- Operational Readiness and Response. This includes the Emergency Response Team (ERT) and Critical Incidents investigations among other duties;
- Technical Investigation Services. This includes the High Altitude Surveillance Program (HASP).

- Witness Protection Program.

The divisions' Commanding Officers report directly to the RCMP Commissioner. In general terms, the organizations within the RCMP Policy Centre are responsible for the following:

a. Create national policy standards and SOPs;
b. Develop national training requirements and provide that training to personnel operating within the realms of their purview;
c. Identify common equipment for use in the daily operations; and
d. Procure equipment to support operations.

Of the HQ organizations interviewed, it was noted that the Protective and Criminal Operations is not a Policy Centre. This group provides investigation of international and highly sensitive situations as well as providing protective details to the Prime Minister, the Governor General and their families.

7.5 RCMP Divisions

Each RCMP division is the responsibility of a Commanding Officer who responds directly to the Commissioner. They are responsible for the day to day operations and tactical use of police assets to fulfil the RCMP mandate. In contracted provinces, the Divisions provide the bulk of their support to the provinces, but a portion of their work is also in support to the RCMP's federal mandate. In the provinces of Quebec and Ontario, they fall under the RCMP's federal policing mandates. The Air Services Assets assigned to their divisions fall under their command and control and are to be used in support of the daily operations while following national policy standards.

Within each of the divisions, there is a Criminal Operations Officer (CROP Officer) directly responsible for Air Services within the division.

8 Federal vs Contracted policing services

The RCMP provides provincial/territorial policing services under contract to all provinces and territories except Ontario and Quebec. It also provides municipal policing services to approximately 180 communities, and Aboriginal Policing. Provincial and territorial policing is typically funded by the contract partner at 70%. Municipal policing is funded by the contract partner based on population, in some cases up to 100% for larger cities. The contract partners, therefore, play an important role in investment decisions.

In most cases, the contract partner must be consulted and approve of any investments over $150,000. This adds a level of complexity to investment planning for contract policing. The federal policing mandate is carried out to varying levels in all provinces and territories. This mandate includes enforcement of federal laws (e.g. border protection, war crimes, customs, immigration), detection and deterrence of terrorism, organized crime and drugs, and international policing, which provides Canadian liaison officers in foreign countries, supports INTERPOL in Canada and supports Canada's peacekeeping efforts abroad.

According to the *"RCMP Investment Plan 2015-16 to 2019-20",* for purposes of Program delivery, the Force is divided into 15 divisions, plus a National Headquarters in Ottawa. Generally, the Divisions carry out operational policing while Headquarters functions as the policy center. The Divisional Commanding Officers report directly to the Commissioner.

9 Aircraft roles and Descriptions

9.1 Aircraft configuration and roles

The RCMP possesses a total of seven (7) aircraft types among them, five (5) Fixed Wing (FW) and two (2) Rotary Wing (RW). Each aircraft type is used to fulfill a primary role and other secondary roles. In the surveillance roles, the aircraft are equipped with surveillance equipment

Annex C provides a summary table describing the configuration and role for each of the RCMP aircraft. Some of the aircraft were originally manufactured for transport purposes,

9.2 Aircraft characteristics

The following provides a summary of each of the aircraft characteristics, providing some additional details on their specific role within the RCMP.

9.2.1 Fixed Wing Aircraft

PC-12

Characteristics:
The PC-12 is a single engine turboprop passenger and cargo aircraft manufactured by Pilatus of Switzerland. The aircraft was designed in the early 1990's and the production started in 1994.
The PC-12 has become one of the most popular single engine turbine-powered business aircraft on the market and it is renowned for its versatility, performance reliability and operational flexibility. The aircraft can be used for passenger and cargo transport,

Mission Performed:
The PC-12 is mainly used for transportation of operational personnel and cargo but also for High Altitude Surveillance (HAS). A significant requirement for the RCMP is the ability of the aircraft to carry an Emergency Response Team (ERT with the supporting personnel (On-site commander, negotiator and occasionally an Explosive Disposal Unit (EDU) specialist)) on scene. Other transportation requirements include the transport of high risk prisoners, persons under the witness protection program and high value personnel, and equipment.

In some cases, the aircraft is used to transport RCMP members in regions where alternatives are very limited and/or impractical.

Cessna 208 – Caravan

Characteristics:
The Cessna Caravan (Grand Caravan) is a single engine turboprop aircraft manufactured by Cessna Aircraft in the USA with production started in the mid 1980's. The C208 has an average seating capacity of 9 passengers but can be extended to 13 passengers. It comes in two variants, the C208, which is the Caravan and can be adapted with floats and the C208B, the Grand Caravan, which is longer and has a more powerful engine but is not suitable for floats installation.

Missions Performed:
These aircraft are used for aerial surveillance with an observer on board. The aircraft can also be used for transportation of people and cargo with amphibious capability, especially for the Caravan located in Prince Rupert.

Cessna 206

Characteristics:
The Cessna 206 is a single engine piston aircraft manufactured by Cessna Aircraft in the USA. The exception to this configuration is the U206G which has been embodied with a Soloy Turbine Pack modification. The aircraft was introduced into service in the early 1960's and is still in production

today. The aircraft was manufactured for commercial air service (can carry up to five (5) passengers) but it is also widely used for aerial work, more specifically, for aerial photography.

The "U" model label stands for "Utility". It has pilot side door and large clamshell rear door serving the back two rows of seats, allowing easy loading of oversized cargo if required.
The T206H is equipped with a turbocharged engine. Certification in Canada is limited to five (5) passengers instead of six (6) due to concerns about passengers egress with aircraft flaps down.

Missions Performed:
These aircraft are used for surveillance.

De Havilland DC-6 – Twin Otter

Characteristics:
The Twin Otter is a twin engine turboprop utility and commuter short take-off and landing (STOL) aircraft manufactured by De Havilland aircraft of Canada. The aircraft was introduced into service in the mid 1960's and has a seating capacity of 19 passengers.
The aircraft was designed for carrying passengers and cargo into remote unimproved locations, including ski and water based operations. The aircraft has been successfully operating in the harshest climatic conditions for over 50 years, and it is renowned for its versatility, performance reliability and operational flexibility. The aircraft can be used for passenger and cargo transport

Missions Performed:
The Twin Otter located in Goose Bay Newfoundland is used for transportation of personnel and cargo as well as : Search and Rescue Operations.

Quest – Kodiak 100

Characteristics:
The Kodiak 100 is a single engine turboprop utility and light transport aircraft manufactured by Quest in the USA. The aircraft was introduced into service in 2005 and can carry 8 passengers. It is designed to land and take-off from unprepared runways. It is also manufactured as an amphibious aircraft when equipped with floats and is capable of water based operations.

Missions Performed:
The Kodiak performs personnel and cargo transport as well as Search and Rescue operations throughout the province of British Columbia. Its amphibious capability allows the aircraft to land and take off from almost anywhere. The aircraft is also used for transportation purposes as required.

9.2.2 Rotary Wing Aircraft

Airbus EC120B – Colibri

Characteristics:
The Airbus EC120B is a single engine turbine powered helicopter manufactured by Airbus Helicopters (originally Eurocopter) of France. The helicopter was introduced into service in 1998 as a 5-seat light multi-mission helicopter. The helicopter can be used for aerial work, including slinging operations as well as for passenger's transportation but is mostly used as police car in the sky.

Missions Performed:
The helicopter has been named the Urban Patrol Helicopter and is used in support of city policing. The helicopter possesses a system that allows day and night searches and directing police forces conducting operations on the ground. The helicopter gets involved in most operations from serious assaults to vehicle pursuits. It is a particularly a strong asset for following crime vehicles and bringing those operations to successful close. The helicopter is not IFR certified but has Night Vision Goggles (NVG) capability.

Airbus AS350 B3 - ASTAR

Characteristics:
The Airbus AS350 is a single engine turbine powered light helicopter manufactured by Airbus Helicopters (originally Aerospatiale) of France. The helicopter was introduced into service in 1975 as a 6-seat light multi mission helicopter. The B3 version has been equipped with the Ariel 2B engine increasing the Maximum Take-Off Weight. The helicopter can be used for aerial work, including slinging operations, as well as for passenger transportation.

Missions Performed:
The helicopter is used for Border Patrol and smuggling interdiction. It is also used for search and rescue operations, repeater antenna repairs and transportation of emergency response teams. The helicopter is not IFR certified but has Night Vision Goggles (NVG) capability.

10 Review available data

10.1 Basic Aircraft information

Basic aircraft information was required to be familiar with the fleet, understand their locations, their role and capabilities. Additionally, to determine some financial parameters in terms of operating costs and procurement options, it was required to get aircraft statistics. To perform this task, the consultant prepared an "Information Gathering Plan" that was reviewed by the RCMP and approved as representing the focus of the study. The generic data requirements are detailed in Table 3.

Table 3 - General and Technical Information and Data Requirements

General & Technical Information and Data				
Information Required	**Available through RCMP**	**Obtained through other sources**	**Not Available**	**Impact if any**
Airframe Information				
List of a/c	Y			
Location for each a/c	Y			
A/C Registration	Y			
A/C Manufacturer	Y			
Year of Manufacturing	Y			
Number of airframe hours	Y			
Equipment installed	Y			
Estimated Life Expectancy	Y			
Engine Information				
Engine manufacturer	Y			

General & Technical Information and Data				
Information Required	**Available through RCMP**	**Obtained through other sources**	**Not Available**	**Impact if any**
Year of manufacturing	Y			
Time between overhaul (TBO)	Y			
Time since overhaul (TSO)	Y			
Avionics Information				
IFR Rating	Y			
Glass Cockpit Equipment	Y			
ADS-B Out	Y			
RNP or RNAV equipment	Y			
Flight Tracking System	Y			

10.2 Maintenance Data

Maintenance can have a significant impact on operations in terms of aircraft dispatch rate, cost of ownership and overall operations. This information is required to assess the RCMP's maintenance practices, to determine each aircraft's operating cost and the impact of the aging fleet on operations and consequently assess the replacement cycle. Those requirements are listed in Table 4.

Table 4 - Maintenance and Logistics Information and Data Requirements

Maintenance Information and Data				
Information Required (Sometimes the information may have been available but not provided within the course of the study)	**Available through Policy Centre**	**Obtained through other sources**	**Not Available**	**Impact if any**
Maintenance Schedule for each a/c	Y			OK
Corrosion Control Program	N	Y		The RCMP uses the Corrosion Prevention Control Program issued by the OEM for all its aircraft. However, during the course of the project, that information was only obtained through discussions with personnel at Air Sections except for the C208 of Prince Rupert for which an issue was raised.
Identify Obsolescence Issues	N	N	Y	May have an impact on the ability to forecast operating cost.
Number of person-hours for each scheduled inspection (annual, 100 hours, etc....)		N	Y	Only anecdotal information on the number of days. Difficult to determine the best maintenance strategy to enhance aircraft availability.
Number of person-hours to rectify unscheduled maintenance actions (snags rectification) per flying hours.	N	N	Y	Impossible to determine the aging a/c effects on maintenance cost and also to assess a/c availability.
Number of lost days due to maintenance activities	N	N	Y	A/C availability and measure of maintenance efficiency.
Delays caused by parts Delivery	N	N	Y	A/C availability and measure of procurement efficiency.

Maintenance Information and Data				
Information Required (Sometimes the information may have been available but not provided within the course of the study)	**Available through Policy Centre**	**Obtained through other sources**	**Not Available**	**Impact if any**
Annual fuel cost per flying hours	N	N	Y	Limited impact but could provide an indication of the increased cost of an aging fleet.
Frequency of outsourced maintenance support	N	Y		There was some information regarding the number of out-sourced inspections performed but not in a consolidated fashion.

10.3 Operational Data

Operational data is required to assess the adequacy of the fleet to perform its missions. Some of the main elements to consider are: mission types, mission mix percentages, time and distance required to travel. The requirements for this level of assessment are presented in Table 5.

Table 5 - Operational Information and Data Requirements

Operational Information and Data				
Information Required	**Available through Policy Centre**	**Obtained through other sources**	**Not Available**	**Impact if any**
List of Mission Types	Y			OK
Average annual flying hours per a/c	Y			OK
Average annual flying hours - trend over last five (5) years	N	Y		Some information was collected through the various interviews but no hard data was provided.
Sortie frequency per a/c	N	Y		Information obtained in relative terms from the bases.
Average sortie length per a/c	Y			OK
Average distance flown per a/c per sortie	N	Y		Anecdotal information was obtained during the various interviews. As data is not available.
Mission mix percentages	N	N	Y	Without this kind of information it is difficult to use actual data to determine the actual needs for a specific aircraft and acknowledge the perceived demands from Air Services Units.
Despatch reliability per a/c	N	N	Y	This has a tremendous impact on the analysis. It is impossible to determine which factor is having the most impact on operations.
Changes in the mission mix over the last five (5) years	N	Y		To a limited extent through anecdotal information through the interviews.

Operational Information and Data				
Information Required	Available through Policy Centre	Obtained through other sources	Not Available	Impact if any
Number of mission requests that could not be completed and the reason for refusing the request	N	N	Y	This is very significant as each unit indicated they had a need for a/c that flew with larger payloads and further but couldn't substantiate the frequency of those demands.

11 Categories of operations conducted

RCMP Air Services are delivered based on a priority matrix as depicted in **Annex F**. As the RCMP is placing greater emphasis on Airborne Law Enforcement in direct support of operations, the number of administrative flights performed is at a much reduced level.

The majority of the tasks performed by air services bases fall along the following main three lines of business:

a. Aerial surveillance and Search and Rescue;
b. Air coverage to active RCMP operations on the ground (including border patrols); and
c. Transport of emergency response personnel, high value assets or high risk prisoners.

There are a few specific flight types that are only performed by individual bases.

- D-Division: two (2) of the division's PC12 are used for transportation of personnel between the various Air Sections that are not served by regular flights or that can only be reached efficiently by air (remote locations). Additionally, in some divisions, the PC-12 can also be used to transport personnel going to Regina for training;
- E-Division: This is the only division responsible for direct policing of large cities. Consequently, they are involved in Urban Patrolling using their EC120s named Air One and Air Two.

There are other tasks also being performed but to a lesser degree and in line with ASB priority matrix but do fall, in one way or another, into the above-mentioned categories. These are:

- Repeater antenna repairs
- Border Enforcement
- Medical Evacuation
- Administrative Duties for Reviews and Inspections

12 Interviews/survey results

The "Information Gathering Plan" that was prepared contained some factual information requirements as presented in the above section. However, part of the study required to understand the actual and perceived needs of those men and women involved in delivering Airborne Law Enforcement (ALE) services on a daily basis. One of the challenges facing RCMP members is the seemingly double allegiance they face when operating in a contract province or territory. The Policy Centre provides them with assets and human resources that do not seem to meet their expectations to provide a 24 hour, 365 days a year service. Additionally, the Policy Centre is responsible to ensure units abide by the rules and regulations implemented while the units are responsive to their Divisions.

Annex D provides the list of questions that formed the basis of the interviews for each of the targeted groups as discussed with the Technical Authority. Each of the interviews was slightly different to delve further into specific information shared by any given Air Services Section.

Generally speaking, when visiting Air Services units, line personnel from the Divisions and personnel from ASB were met to gather their different perspective. For other interviews, personnel were consulted specifically for their role within ASB or as ASB's clients. Consultations were performed for the most part in person but due to time and budget constraints, some interviews were performed over the phone with an attempt to reach out to at least one base per province or territory. Whenever possible, two team members participated in the interviews to ensure a better understanding of the discussed elements.

The stakeholders were divided in five (5) groups:

a. Air Services Section personnel;
b. RCMP Divisions Crime Operations (CROP) Officers;
c. Air Services Branch Policy Centre personnel;
d. Other RCMP Policy Centre personnel or equivalent responsible staff; and
e. Stakeholders of interest.

However, for the most part, Air Services Section personnel and Line Officers were grouped together as the same information was required of them but in some cases from a different perspective. **Annex E** provides a list of the personnel that was consulted for this study.

12.1 General comments

In meeting with the staff at various bases, it was clear that the RCMP benefits from being served by personnel that are professional and dedicated to ensuring a high level of mission success. They demonstrated a high level of care for the safety of their fellow officers and of the population at large.

This was quite an exhaustive task and required significant time in performing. The drawback was that there were many anecdotes shared but a lack of actual data. The interviews were held to gather operational requirements and understand in an impartial way the constraints facing the RCMP ASB. However, there is very little data being systematically gathered with the objective of measuring performance and deficiencies. Consequently, interviews led to discussions on the shortfalls perceived by each of the air sections but with very little data provided. Some units had developed locally produced tools to keep track of a number of elements, but that is not a standard across the force and it was difficult to assess its relevance. The consultant was expecting to have access to standardized tools, sanctioned by the Policy Centre, but none were available.

In some cases, the information gathered during the interviews could not be used directly to draw conclusions but provided a number of avenues to further pursue. Additional research ensued to understand the nature of the responses and validate their impact on operations while developing recommendations. However, the information gathered on a variety of issues is of real concern and needs to be addressed. The following provides a summary of the interview results.

12.2 Consultation Results – Air Services Bases Perspective

The first interview results presented within this study are those obtained from interviewing personnel within the targeted air services bases. Generally, personnel present during the interviews were the Officer In-Charge (OIC) of the base with a selection of pilots, as available, and the Aircraft Maintenance Engineers (AME). Although the interviews were conducted based on the "Information Gathering Plan", the results have been organized into seven (7) categories that provide their perspective into the delivery of air services to their divisions.

12.2.1 Aircraft performance

Each of the Air Services Bases' staff provided an assessment of the capability of each aircraft they were flying to deliver the mission. The comments are grouped in the following four (4) categories: Reliability; Payload; Range/Endurance; Concerns, The "Concerns" category provides an opportunity to provide details of aircraft specific concerns that do not fall in the other three (3) categories.

PC-12

Reliability: The aircraft has been very reliable over the years and is easy to maintain. The Air Sections operating this aircraft agree that it has performed beyond the original expectations.

Payload – In a passenger carrying capacity role, the aircraft is used either as a means of transporting personnel to remote locations or to provide transportation to specialized RCMP teams. In the transport or members in most regions, the payload capability is reasonable allowing for eight (8) to 12 passengers depending on the distance to travel. For transporting specialized teams, the number of passengers is limited to four (4) to six (6) people due to the equipment that is required to be carried on board the aircraft. The consideration to take into account for the selection of an aircraft for this type of work is that any replacement aircraft may not have the ability to land on many of the unprepared runways that are served by the RCMP.

The aircraft is also used for HAS and as such payload is not an issue.

Range/Endurance – With a full load of fuel and regular passengers (no baggage) up to 6, the aircraft has decent range capability. This is a little more problematic for transporting ERT members (4-5) with their full gear providing no more than 4 hours of endurance when factoring in alternates, and a minimum of 45 minutes reserve. The legacy PC-12's are less capable than the new generation.

Also, there are occasions that the aircraft is required to travel a long distance across the United States (USA) and the aircraft cannot make it in one leg. Arguably, this is a rare occurrence.

Concerns: For the units flying around mountainous terrain, there have been concerns that this is a single engine, single-pilot operated aircraft. Some pilots would feel more comfortable flying with a twin engine and a two-pilot operated aircraft, especially in IFR conditions. Some of the same concerns, although to a lesser extent, have been voiced for flying over water in a single engine aircraft.

At the moment, there are PC-12's in the country.

. It has been suggested that another PC-12 be procured and a redistribution of the assets be made to have an almost complete coverage of the country. At the same time, the aircraft can be used for transporting personnel. The PC12 has a limit to the size of the ERT team it can transport. This has been compensated for by using two aircraft, if available, having the same aircraft do several trips or use ground transport to get all team members and the gear on site. The potential risk here is in the ability to respond in a timely manner to an urgent situation.

Cessna 208 – Caravan

Reliability: From the interviews conducted, it appears that the Cessna 208 requires approximately 3 hours of de-snagging for each hour of flight. This cannot be confirmed as the data is not tracked, but it is a point to consider.

Payload: For the surveillance role, payload is not an issue for this aircraft. It is a large aircraft and has sufficient capability for the role. In the case of its passenger operation serving the BC coastal areas where access via aircraft (on float) is the only means, a higher payload capability would help.

Range/Endurance: The Caravan is used in Montreal and Prince Rupert (PR).
PR the aircraft is used for transport of personnel.
the range limits the aircraft to an endurance of four (4) to six (6) hours. Given the base in Montreal is responsible for the whole province of Quebec and to support the Maritimes, the aircraft has to plan refueling stops to reach the required destination

Concerns:

Corrosion - The aircraft in PR has been exposed to the salt environment for many years and is showing significant corrosion issues.

Cessna 206

Reliability - There are two versions of the C206. The piston version (T206H) and the turbine version with the Soloy conversion kit (U206G). The reliability of the turbine version is, anecdotally, better than its piston version.

Payload: The aircraft is not normally used to carry passengers or cargo. The only equipment installed on the aircraft is the surveillance system. Payload is not an issue.

Range/Endurance: Taking into consideration minimum fuel required at destination and potentially alternates, the aircraft has a three (3) hour autonomy. Given that the critical success criteria for these types of missions is the on-station time, this may prove problematic if surveillance is to take place at some distance from home base, but otherwise works well at the altitude band required.

Concerns:

Space – The C206 is a good aircraft with reasonable passenger carrying capability. However, when the aerial surveillance equipment is installed, the space inside the cabin becomes very restricted. There are concerns that in that configuration, egress in case of emergency would be hazardous. The potential interference with the aircraft flaps (when extended) during egress is also a concern. Following refusal to work incidents, an Ergonomics Evaluation was performed with

recommendations to complete a full ergonomics assessment and modify the aircraft to provide safe operation of the TFO.

Noise – Although the aircraft has the advantage of operating at lower altitudes, this may be problematic The aircraft, being a piston aircraft, produces more noise and is more easily detectable. The turbine version is quieter and provides better functionality. From Reference E, a Cessna 206 piston turbocharged aircraft would have a noise level in the range of 70.2 to 71 DBA while the equivalent turbo-prop engine will have a noise signature of 62 to 68 DBA in the same conditions of weighted sound levels measured in accordance with FAA part-36 appendix -c- procedures. Decibel is a logarithmic scale which means (approximately) that the noise is about twice as loud between the two aircraft. The RCMP aircraft have had new lower noise production propellers installed which reduces the noise. But the difference between the piston and turbine engines will remain.

Weather – The 206 doesn't have the ability to fly into known icing conditions limiting the days of operations, especially in locations with frequent severe weather patterns. Additionally, given that it is a single engine piston aircraft, it is more susceptible to cold and bad weather.
Fuel – Piston engine aircraft require Avgas. This fuel is being banned due to the lead content and will be forbidden for sale in Canada and the US by 2018 as per **Annex I**. It is already difficult to find Avgas supplies in the north and when available, it often has to be prepositioned for certain types of operations and has become very expensive.

Maintenance - Downtime for maintenance is an increasing problem according to the interviews conducted. This factor should have been validated with actual data that provides a differentiation between scheduled and unscheduled maintenance.

De Havilland DC-6 – Twin Otter

The Twin Otter is used only in Goose Bay for the transport of personnel, prisoners and witnesses. Overall, the aircraft is pristine and is very well adapted to the work in that environment.

Reliability: Except for a few occasions, the aircraft has been quite reliable over the years. There is no data to validate that information but based on the personnel involved in that operation for many years, the downtimes due to unscheduled maintenance have been reasonable. One element to consider and that pales this affirmation is that the aircraft was recently down for engine problems for a four (4) month period. This may point to some obsolescence issues that are showing up on the aircraft

Payload: This is a work horse with a very good payload capability.

Range: There have been no issues reaching the required destinations with the aircraft.
Concerns: No real concerns about this aircraft. It is believed that a replacement aircraft for this type of environment needs to be another twin engine aircraft with similar payload and range capabilities.

Quest – Kodiak 100

Reliability: The Kodiak has flown very little since it has been put into service. It spent the last year waiting personnel resources and a contract to be put in place to proceed with the repair of serious damage. Since its introduction into service in 2011, it has flown less than 550 hours. During the time it was serviceable, the aircraft spent most of its time performing Search and Rescue operations.

Payload: None raised.

Range: None raised.

Concerns: None raised.

Airbus EC120B – Colibri

Reliability: The helicopter has been quite reliable and there are no significant issues with the EC120B

Payload: The helicopter has limited payload capability. It has been designed as a multi role helicopter and to get a reasonable amount of time airborne,
the helicopter as it is outfitted is limited to the pilot,

Range/Endurance: The helicopter has an endurance of about 2 hours, which can prove to be a small amount of time when support is often required for a longer period of time.

Concerns:

Operating Capability – The helicopter is not IFR certified and that can pose a number of challenges while flying night operations when weather is marginal. It is, however, NVG capable.

Engine – The helicopter is used most of the time over highly populated areas. Commercial operators are required to fly twin-engine helicopters in those conditions which is the same approach adopted by other government organizations such as Transport Canada and the Canadian Coast Guard. However, many other police forces in Canada and the US operate this helicopter for city patrols.

Airbus AS350 B3 - ASTAR

Reliability: The helicopter has been quite reliable and there are no significant issues with the AS350

Payload: The helicopter is a good helicopter but when they have the need to transport ERT members to location the helicopter has a limited payload capability. The helicopter is used for insertion and extraction of personnel but with a pilot and three (3) ERT members with their full load of gear, the helicopter has reached its payload capability. This does not meet the ideal number of ERT team member to be transported for incidents. However, it seems that this meets about 80% of the mission requirements.

Range/Endurance: At full payload capacity, the helicopter has an endurance of no more than 2.5-hour fuel capacity.

Concerns:

The helicopter has a single turbine engine. Turbine equipped aircraft are normally quite reliable. However, some pilots do have concerns when flying over mountainous terrain or over water. In the Maritimes, although possible, it is not safe to reach Newfoundland by flight with the A-Star. The helicopter has to be handled (folding blades) and shipped by barge and handled again once at destination.

However, this situation occurs only a few times a year and the province has found alternate ways to fulfil their needs. Also during SAR missions, the aircraft does not have the ability to perform rescue operations once a missing person has been located. They do not have the required rescue equipment.

12.2.2 Maintenance

The RCMP uses a ratio of one (1) AME per aircraft. This seems to work well in situations where there is a critical mass at a given Air Section to be able to distribute the workload and absorb days off, vacations, etc. The Air Sections with more AMEs had an easier time covering off maintenance issues. Places where only 2 AMEs or less were present, has proven to be an extremely challenging situation. There needs to be some rationalization performed in order to ensure there is a critical mass of personnel in each, or at least most of the Air Sections. Also, there is a situation in Vancouver where the Air Section has been divided in two bases separated by a 30-minute drive. Arguably, there are AMEs in each location, but the ability to increase the required flexibility has been taken away.

In each of the bases, AMEs are required to perform a number of other tasks, such as procurement, facilities cleaning, etc.... Again these non-maintenance tasks, that are necessary, are more easily absorbed by the larger Air Sections and have a lesser impact on maintenance activities. Luckily, the majority of aircraft do not have Daily Inspections (DIs) and routine inspections (for instance the PC12 seven-day check) are planned around flights in Ottawa or other units when a given Air Section is short on a particular AME. Also, rectification of snags cannot be performed without augmentation. This is a significant issue.

It was indicated that the performance of scheduled annual maintenance rarely takes less than two (2) weeks and often more due to staff availability. Further delays are often encountered when replacement parts are not readily available. Stations with fewer AMEs tend to need longer to perform scheduled maintenance. Outsourcing has been used on a number of occasions to help but there is no planned approach to effectively carry out scheduled maintenance activities. The personnel shortages are known but there is no Master Plan to ensure maintenance is performed in a way to ensure aircraft are returned to service quickly. This Plan will help in identifying the requirements ahead of time and to ensure proper contracts or parts procurements are in place to minimize impact on the schedule. However, in the business of Air Operations, it happens regularly that parts need to be procured or contracts need to be in place very quickly without prior warning. The RCMP needs to find ways to be more responsive and flexible.

For the most part, the information that was shared with the consultants is anecdotal as there are no systematic requirements to capture data that would help make decisions on maintenance organizations and potential alternative methodologies. Some had locally captured data that isn't sanctioned by higher level, but the information was very recent and not always systematically gathered. The assessment of their situation is difficult.

The AMO is located in Ottawa with limited resources. Although efforts are being expanded to standardize maintenance practices, there is still a limited amount of oversight, which is required to have a well-integrated system that optimizes existing resources. There is an internal audit process that is mostly ad hoc and needs to be strengthened and structured.

Specialized work is done under contract as there are only three (3) avionics technicians in Ottawa and one (1) in Vancouver.

Most people received the arrival of the new maintenance software as a blessing. They had been working with antiquated software for nearly 20 years. Their existing software being incapable of providing meaningful information in terms of efforts spent fixing aircraft. The implementation should take into consideration the experience of the field units prior to full deployment.

Maintenance centralization or outsourcing was not badly received when the concept was introduced. Most Air Sections would welcome a more structured approach to the delivery of aircraft maintenance. However, it was perceived that the contracting mechanisms in place were serious hurdles in having the flexibility to rapidly have access to contracted resources. Generally speaking, their experiences have been that scheduled maintenance is a standard number of hours but the

corrective actions required are not normally covered in the original contracts and need cumbersome contract amendments.
In many instances, aircraft are removed from service due to scheduled maintenance without looking at the big picture, there is no real attempt at ensuring there is a good stagger of scheduled maintenance in a province or a region. This leads, for instance, not to have PC12 available in western Canada as they may be in maintenance at the same time. There is a need for a more centralized management of maintenance activities.

12.2.3 Logistics

Parts delivery has been slow. Parts ordered through Ottawa has been faster over the last few months as the store's position has been filled permanently but since the parts store in Ottawa is not supported 24/7 it may cause delays. It was however, impossible to assess the impact this situation had on operations. This has caused some of the Air Sections to push for the ability to purchase their own parts directly from the suppliers. The main issue with this situation is to ensure traceability and ensuring the process follows strict Transport Canada rules and regulations.

The establishment of better min/max of rotable spare parts by Ottawa over the last three (3) years has helped improve the situation.

Contracting for services is perceived as a long and tedious process. This was exemplified by the time it took to get a repair contract in place for the Kodiak. The RCMP needs to have in place a process that is responsive to its operational needs. It is understood that pre-existing requirements are more easily handled but given the nature of the operations, the RCMP needs to develop the tools to be more flexible and responsive to logistics requirements.

12.2.4 Human Resources

The pilots flying for the RCMP have all in excess of 7,000 flight hours. In addition to the continuous and rigorous training this is a real positive element to RCMP flight operations, and at the same time the experience and training provide a risk mitigation element for missions that have a higher level of risk.

The units are not staffed to respond to emergency calls 24 hours a day 7 days a week. Units operate under a shift schedule that varies between the units. Given that there are two (2) pilots per aircraft, pilots attempt to cover off weekends in an alternate fashion. This works well when they are not on leave or training. Arguably, there are fewer weekend demands and this is therefore when personnel take their days off. Larger units have some latitude to fill-in for aircrew away sick or on leave.

There are no good scheduling tools and flight coordinator positions are not present in all the units. Additionally, the units have to themselves to decide when an Air Section will be staffed and when there will be no person on duty. There needs to be a direction from the ASB Policy Centre in consultation with other Policy Centres to establish some direction and have some form of consistency that is fair to all personnel and at the same time optimizes personnel availability.

The situation with the AMEs has been covered in the previous section and also needs to be addressed. This is arguably the most serious shortfall in ASB operations.

Personnel replacement is a long and tedious process that has a significant impact on RCMP operations. The hiring process may take up to 12 months, which especially in small Air Sections, may have a tremendous impact on operations requiring a series of work around to ensure safe and efficient operations.

12.2.5 Operations organization

Each Air Service base operates under the policy and overall guidance of the Air Services Branch Policy Centre. However, they fall under the daily operational requirements of the RCMP division which in most cases, except for Ontario and Quebec, the assets are operated under contract with the provinces where they reside. This arrangement, although there are provisions in the contracts between the federal government and the provinces to be able to do so, makes it very difficult to re-allocate both equipment and human resources across the country to ensure more pressing missions are completed first.

In recent years, an aircraft booking form (Form 3640) was developed to capture requests and to increase dispatch efficiency. However, this is poorly used and in some cases only recently has it been implemented in some regions. In many cases, Air Sections accept tasking by email or over the phone. When the tasking is accepted, the flight will be recorded in PFM. However, in cases when the flight is not possible, there is no record of a flight being denied and the reason for denial. This is problematic as it is impossible to fully understand the real demands on ASB, which allows the organization to adapt and effectively respond to the demands.

Situations do occur where aircraft need to be chartered. The effectiveness of this action varies between regions. There are some cases where there exists Standing Offers for aircraft chartering but this is not the result of a systematic approach. As it will be impossible for ASB to have every aircraft model to cost-effectively satisfy each situation, there will always be a requirement to charter aircraft. ASB needs to plan ahead and have in place pre-approved arrangements with regional commercial operators to support RCMP operations. It also has to be pre-arranged that those chartered flights could have members carrying arms and other equipment.

12.2.6 Operational challenges

The personnel met at the various air stations were keen and eager professionals who are dedicated to providing the best possible support to protect the public and their fellow members. In discussions with the various bases, there are a number of challenges that were identified and reported and a number of them have already been addressed in other sections of this report. There are a few elements that should be considered in moving forward to improve the situation.

On the communication side, the expectations that air services are supposed to support their divisions' demands seven (7) days a week 365 days a year in all conditions is a strong belief among

personnel. Although they understand this cannot occur with their present resources, this is a cause of frustration as they feel they should have the staff and the assets to be able to perform to that level.

With better planning tools, more guidance, increased coordination and better communication from the Policy Centre this situation would improve somewhat. Additionally, it would take some of the pressure off the various Air Sections.

When aircraft are not available, it is difficult to lean on other government organizations such as TCCA, CCG and RCAF. MOUs exist but they are outdated and in any case, their organizations will fulfil their own priorities first unless it is a high level crisis situation. In most cases, these organizations are not able to respond quickly enough to a crisis situation.

12.2.7 Other comments

It has been highlighted that for the same aircraft, checklists vary between Air Sections. Each unit being confident their approach is better, but not concerned with the need for standardization. This may have some safety implications and has to be resolved with increased oversight.

12.3 Consultation Results – RCMP Divisions Criminal Operations (CROP) Officers' requirements

At the divisions' level, the CROPs' officers are also expecting a higher level of support. They see air assets as policing enablers and force multipliers. Many feel the frustration as assets are not always available when they would like to use them or that the right aircraft, arguably on few occasions, are not in inventory. Although anecdotal, it is clear that across the country, "clients" do not request air support for their operations when they could, simply because they are fully aware that the assets are not available or not mission capable. This prevents the use of arbitrary information to make educated well supported decisions. In this situation, it is difficult for ASB to base their fleet requirements on information that is not available. This information is not captured and it is difficult to assess the actual needs.

It is clear that the CROPs wishes and the associated responses by the Air Sections are in sync. Consequently, the pressures from the Divisions are well understood by the Air Sections, and they have made them their own. This is being done and since there are no tracking tools, the demands, although rare in some cases, do become the minimum in terms of aircraft and equipment.

12.4 Consultation Results – ASB Policy Centre' perspective

12.4.1 Operations

The ASB policy centre has been well aware of the deficiencies observed at the bases. Many initiatives have been put in place over the past two (2) years to improve the situation and ensure Air Services is accountable. A few key initiatives include efforts to increase the level of cohesiveness

across the country, the emphasis put on the SMS system and the procurement of a maintenance management software.

The Policy Centre provides oversight through four (4) different channels: Operations Manager, Rotary Wing Chief Pilot, Fixed Wing Chief Pilot and Maintenance Manager.

The implementation of practices to improve standardization of practices is challenging. The units receive their daily operational tasks through their Divisions and the link with the Policy Centre, although this has improved tremendously over the past two (2) years, comes second. The operations at Air Services Sections are conducted in accordance with Airworthiness rules and regulations, but the tools that would be required for Air Services Branch to become more efficient and effective are not always implemented as intended.

The Policy Centre is also responsible for the pilots' recurrent training and continued proficiency. Each pilot receives a combination of ground school, simulator training and pilot competency check (PCC) flight on an annual basis. The pilots visit approved training facilities that have been contracted by the RCMP for their annual training and the chief pilot from the Policy Centre performs audits of each unit and performs a PCC.

The Divisions provide the operational tasking and that information is not necessarily shared with the Policy Centre. In the event that there are shortfalls, it makes it difficult for the Policy Centre to support the field as they cannot anticipate and pre-plan.

12.4.2 Maintenance

Maintenance Engineers are all very competent and well trained. The Policy Centre has implemented a number of initiatives to improve their work and increase efficiencies. The parts procurement cell has been manned permanently by a person that performs these duties exclusively, a new software called WinAir has been procured to track the work and allow the Policy Centre to better support maintenance at the bases. Some maintenance issues are:

a. There are no standard targets against which to measure maintenance efficiency and performance;
b. There is no coordination between units for scheduling aircraft maintenance with the potential consequence that in a region there may be no aircraft available to perform a given mission;
c. There are no means of capturing the various stages of aircraft preventive maintenance, corrective maintenance and other delays caused by parts unavailability;
d. There is no Master Planning to increase efficiency of maintenance activities as each base handles their maintenance in a different way without a national focus to increase assets availability. There has been attempts to perform this but it has been Ad Hoc to date;
e. The ratio of one AME per aircraft is problematic for bases where there is only one aircraft and the AME is away for any length of time. Although attempts are made from the Policy Centre to find alternate solutions, this is problematic.

Although there are many issues to be resolved for the implementation of the new maintenance software WinAir should provide an enormous improvement over existing software. The capability exists to use this new application to increase maintenance efficiency if the right parameters are put in place. For instance, with WinAir it should be possible to implement a Master Plan that will provide visibility and real maintenance planning for the fleet. It can help making it easier for units to manage their inspections and optimize schedules. It should also be possible to develop an application to interface between WinAir and PFM.

12.4.3 Safety Management System

There is now a functional Safety Management System (SMS) that is managed by one person on a full-time basis. This is a key to quickly resolve safety concerns and issues. The SMS Manager now reports to the Operations Manager preventing any conflicts of interest. Much progress has been made over the past two years to instill a safety culture within ASB. There are still differences across the country and more efforts need to be pursued.

Within the Policy centre, it has been taken seriously and is part of the weekly meetings as it should be. The Director General ASB is the accountable executive. This position changes every two (2) to three (3) years and as such carries an inherent risk that needs to be mitigated.

12.5 Consultation Results – RCMP Policy Centre – Clients' needs

Air Services' clients have been consulted to determine their view on the services provided by ASB and to discuss their needs. The organizations consulted are:

a. Operational Readiness and Response;
b. Technical Investigation Services; and
c. Witness Protection Program.

12.5.1 Emergency Response Team

The ERT forms part of the overall Critical Incident Package (CIP) and is responsible for responding to critical incidents that require a tactical response. There are ERT members in all the Divisions but their numbers vary depending on the needs and staffing levels authorized. ERTs are managed divisionally, but the standards and tactics along with the direction and policies are managed nationally and fall under the Contract and Aboriginal Policing Branch.

ASB is an integral part of the success of the CIP and is called upon for the vast majority of ERT incidents. In many instances, for highly critical incidents, ERT members are brought in from other divisions to resolve the incident. The scope and nature of the duties performed across the Divisions is essentially the same except for the coastal and Great Lakes teams that are also responsible for marine security.

ASB conducts three main services to the CIP and the ERT's.

a. Air Lift Capability – to move personnel and equipment quickly to remote or far away locations when an incident occurs;
b. Real Time Aerial Surveillance – providing an aerial view and real time intelligence to the ERT ground force and the command post where the remainder of the Critical Incident Package runs an operation.
   This role requires a Tactical Flight Officer familiar with ERT tactics.
c. Tactical Transport – Use of the Tyler Special Operations Platform, for instance, on the rotary wing aircraft. Medivac of injured persons during an event, or infiltration/exfiltration from remote/rugged terrain.

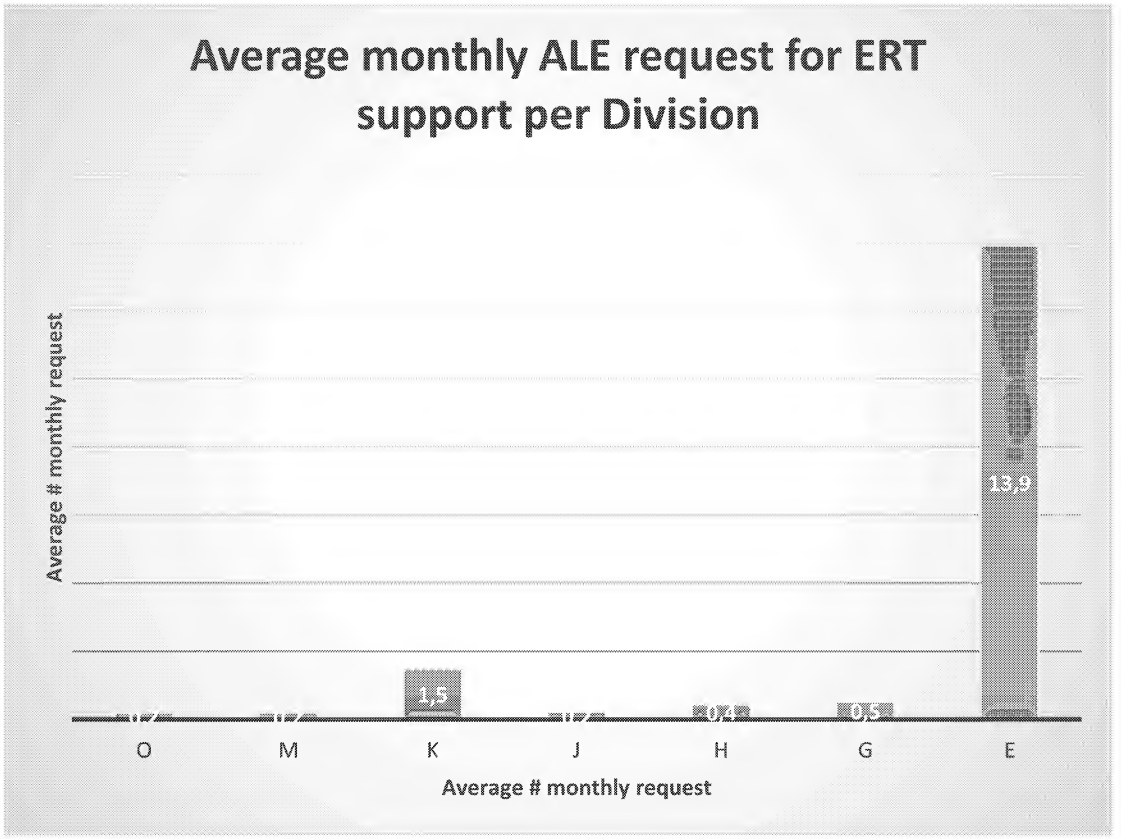
During the interviews conducted, the most significant issues raised related to ASB's challenges in meeting all the current and five (5) year horizon demands from the ERT current and on a predicted horizon of approximately five (5) years based on their current and desired roles. The requirements can range from 4 members for a typical protective policing mission to 12 or more plus supporters (Special Investigation, EDU, negotiators, scribes, radio techs and EMRTs) for a barricaded person or man hunting missions. On a large-scale event, additional ERTs and supporters are deployed to increase the span of control or as replacements in a prolonged event. Arguably, augmentation would be flown subsequently once the situation has been assessed, and as it develops.

ERT demands are highlighted at Annex G. They are very broad and specific. To fulfil those demands, ASB would have to have at least a King Air 350 and potentially a Dash 8 to fulfil the requested requirements. Those aircraft would have to be highly configurable requiring increase aircrew and increased ground crew. The consultant received three years of ERT calls and the associated requests for ASB support allowing a quick analysis of the number of such calls on a monthly basis and the required assets.

Table 6 - ERT Calls Statistics 2013 - 2016

Division	Province	Total # of ERT Calls	Total # of ERT Calls - ALE Requested	Avge # Requests per month (38 months)	% ALE Requested	# ALE Available	% ALE Available	# ALE not available	% ALE not available
O	Ontario	7	7	0.2	100%	5	71%	2	29%
M	Yukon	20	7	0.2	35%	3	43%	4	57%
K	Alberta	56	56	1.5	100%	34	61%	22	39%
J	New Brunswick	62	8	0.2	13%	0	0%	8	100%
H	Nova Scotia	16	16	0.4	100%	2	13%	14	88%
G	NWT	43	19	0.5	44%	0	0%	19	100%
E	BC	717	529	13.9	74%	46	9%	483	91%
Total	Total	921	642	16.9	70%	90	14%	552	86%

Figure 1 - Average monthly ERT demands for ALE per Division



From the data collected, and as presented in Table 6, there are strong indications that Airborne Law Enforcement Assets are not available for most of the ERT requests except for Alberta and Ontario where 61% and 71% of the requests were met. For most of the Divisions, the demands

remain under once a month. Exception being Alberta (1.5 monthly demands) and British Columbia (13.9 average monthly demands).

Upon further data analysis, E Division's most frequent requirements are for a manoeuvrable light helicopter equipped with surveillance equipment able to provide over watch support for ground troops. For this type of work Air 1 is adequate for the work but indications are that the helicopter was not available during those demand periods without data capable of providing dispatch availability rate, it is not possible to draw clear conclusions. Additionally, it is impossible to draw conclusions on the impact of not having the support required when requested.

There was only a need for 3% (about once a month) of helicopter transport requiring a helicopter capable of transporting a small ERT team and 6% (twice a month) of the time, Fixed Wing aircraft would have been required to transport ERT members. In those cases, ground transportation was used. It took longer for ERT to arrive on the scene and the consequences of those delays are not recorded if any.

12.5.2 High Altitude Surveillance Program (HASP)

12.5.3 Explosive Disposal Unit (EDU)

EDU demands for ASB transportation assets are limited. Most of the time, they travel by road. Aircraft availability has not been a serious issue.

12.5.4 Witness Protection Program

There are eight (8) units across the country involved in the witness protection program. The number of transportation requests is not actually tracked but on average, each province has need for witnesses transport twice a month.

12.6 Consultation Results – Other stakeholders' perspectives

Senior officers responsible for management of ASB were also interviewed. There is complete knowledge of the issues raised by field units. However, the information gathered is limited making the decision-making process more challenging. It is believed that some aircraft and equipment are not well suited for the type of work performed, and this needs to be addressed. They are looking for a 20-year plan that will provide direction for ensuring ASB air assets are in place to meet operational demands in a safe, effective and efficient manner. In providing this long-term plan, it is required to consider the frequency of the demands, the safety of aircrew and the support that needs to be implemented to deliver the capability.
Moving aircraft from one region to another to fill a temporary need was possible and there is a process in place to allow this to take place. However, given the high level of decentralization of the Air Services Branch, it is difficult to have a seamless coordinated approach that will ensure the most efficient use of resources when it is the most needed.

Apart from the regional transport of witnesses under the witness protection program, the movement of prisoners, high value assets and the movement of members for operational reasons across the

country, the two operations with the highest demands were deployment of Emergency Response Team (ERT) members and High Altitude Surveillance Program (HASP).

The ERT demands are to have larger aircraft to allow a full complement of ERT members to be deployed anywhere at any time. However, to date the demonstration has not been made that there were sufficient incidents to procure a dedicated airplane. For surveillance missions, those are, for the most part, planned ahead and the assets are made available to perform the required missions.

13 Evaluation of the Optimal Aircraft Platforms

The first observation that is apparent is that the data that would be required to make a thorough and solid evaluation based on facts does not exist. There are pieces of information gathered by individual Air Sections but nothing is gathered systematically that will provide an impartial analysis of the needs of the force. The consultant has had to rely on information gathered through interviews, consultation with industry and a review of the operating cost of a variety of aircraft that would take in consideration the recurring Operation and Maintenance cost for each aircraft.

For this exercise to be completed properly and for the RCMP to be equipped with the right tools in the future, here is the data that would be required:

a. A compilation of every demand for Air Support;
b. The parameters for the support requested;
c. The number of rejected demands and their reasons;
d. The consequences of not having a demand met;
e. The alternate solution to make a determination if the alternate solution is as effective and less costly;
f. The cost of operation per flying hour; and
g. Unscheduled maintenance downtime.

Based on the information gathered and some efforts of validation based on accepted industry practices an analysis on the various options has been performed to provide some recommendations on the optimal platforms for RCMP Airborne Law Enforcement operations.

One of the steps taken was a benchmarking exercise where some organizations with operations that were neighbouring RCMP's were used. In some cases the benchmarking organizations were selected for their type of operations and in other instances, they were selected for the type of aircraft they were flown.

This section will consist of analyzing the options that seemed like the candidates with the most potential for the type of operations carried out by ASB. They were based on operational requirements and may consist of the following options for each of the aircraft type for the roles exercised by ASB:

Option A - Status Quo;
Option B – Fleet of mixed aircraft with the best specific aircraft for each mission role;
Option C – Limited mixed fleet with an effort to have an homogenous fleet for each type of role but with some exceptions where the demands/requirements is the strongest; and
Option D – Homogenous fleet for the same role.

13.1 Validation of points raised – Data

It is relevant to perform a quick review of the strengths of each of the aircraft presently in inventory as for the most part they are able to complete over 80% of the required missions in a satisfactory fashion at a cost that is commensurate with the constraints of the federal and provincial governments. The following comments are based on the industry's views on the aircraft based on their use and the missions they perform.

13.1.1 Fixed Wing Aircraft

PC-12

The Pilatus PC-12 is normally selected by operators for the following reasons:

Space/Comfort – The aircraft has a spacious cabin allowing ease of movement from passenger and a significant cargo area.

Single pilot – The aircraft is certifies for single pilot operations reducing operating cost.

Reliability – The aircraft has been designed with a high level of reliability in mind. This was a key feature given the single engine operation. It is equipped with one of the safest and most reliable engine on the market, the PT6A. Pratt & Whitney is able to rely on a massive amount of data that demonstrate engine reliability and required improvements.

Operating Runways – The PC-12 has the capability to land and take-off from unprepared surface runways. Additionally, it has exceptional short runway performance, being able to take-off in less than 2000' (as little as 1500').
Cargo Door – The aircraft is equipped with a large cargo door allowing ease of cargo loading and unloading.

Cessna 208 – Caravan

The Cessna Caravan is normally selected by operators for the following reasons:

Space/Comfort – The aircraft is reasonably spacious to accommodate passenger (normally 9) and/or surveillance equipment.

Single pilot – The aircraft is certified for single pilot operations reducing operating cost.

Reliability – The aircraft has been a very reliable aircraft and still holds a high dispatch reliability rate internationally. Also, the fact that the aircraft is unpressurized and has fixed landing gear, lends itself to this high level of reliability.

Operating Cost – The aircraft has very favorable operating costs.

Cessna 206

The Cessna 206 is normally selected by its operators for the following reasons:

Single pilot – The aircraft is certifies for single pilot operations reducing operating cost.

Operating Cost - The aircraft is reasonably affordable to operate. It is a simple aircraft with no life limit.

Operating environment – The aircraft can operate at lower altitudes even during lower cloud conditions

De Havilland DC-6 – Twin Otter

The Twin Otter is normally selected by its operators for the following reasons:

Space/Comfort – The aircraft has a spacious cabin allowing ease of movement for passengers and a significant cargo area.

Single pilot – The aircraft is certifies for single pilot operations reducing operating cost.

Operating Environment – The aircraft is capable of operating in the harshest environment on wheels, floats and skis. It can take off and land on almost any type of surface in less than 1200'. It has a very low stall speed allowing the aircraft to safely fly low and slow.

Payload – The aircraft, with a full load of fuel and pilot still has a high usable payload (nearly 3000 lbs.) and an effective range.

Quest – Kodiak 100

The Kodiak 100 is normally selected by its operators for the following reasons:

Operating Environment – The aircraft is capable of operating in difficult conditions. It can take-off and land on almost any type of surface in less than 1000'. It has a very low stall speed allowing the aircraft to safely fly low and slow.

13.1.2 Rotary Wing Aircraft

Airbus EC120B – Colibri

The EC120B is normally selected by its operators for the following reasons:

Reliability – The helicopter has had a good safety record.

Operating Cost - The aircraft is one of the lowest light helicopters operating cost on the market. It is a simple aircraft equipped with a reliable turbine engine. It is used by many law enforcement organizations

Maneuverability – The EC120B is a highly maneuverable and its agility is an asset during high speed vehicles pursuits.

Airbus AS350 B3 - ASTAR

The A-Star is normally selected by its operators for the following reasons:

Space/Comfort – The helicopter is equipped with large side doors and can accommodate between four (4) to six (6) passengers depending on configuration and fuel load.

Operating Cost – Airbus has designed a helicopter that, compared to similar capability models on the market, has a lower operating cost.

13.2 Twin Engine versus Single Engine Aircraft

During our interviews, there have been many issues made that in many circumstances, single engine aircraft were a higher risk and less safe operations. The following is the result of some research performed by the consultant in an attempt to shed some light on the situation and assess the risk reduction of a twin engine helicopter and the price tag associated with that solution.

The information contained herein is not to debate the relative merits of single versus multi engine aircraft operations specifically, but to look at the relative merits in context of the RCMPs operations.

There are many opinions written on the merits of single engine versus twin engine safety, some backed up with statistics where their veracity can be put in to question. In fact, there is enough data to support an argument for or against twin engine operation, depending on the author's bias.

It is also important to remind the reader that safety is not an absolute; rather it is a relative measure of the risk involved when flying in an aircraft.

In all the interviews conducted with the RCMP Air Services in the course of this project, the subject of safety in flying single engine fixed wing turbine aircraft rarely came up and when it did, it was in the context of an afterthought to a broader discussion about the effectiveness of the PC-12 in RCMP operations.

In order to make any recommendation that has to do with single versus twin engine operations in the context of the RCMP Air Service, it is important to first take a look at the dynamics involved in sudden power loss in both fixed and rotary wing operations.

If a fixed wing aircraft loses power, the pilot adjusts the nose down pitch of the aircraft to get the best glide angle for maximum range and keeps the airspeed above the stalling speed until ground contact. The airplane's airspeed at ground contact will be typically 60 to 100 knots which requires a shallow approach angle and a cleared landing site. The approach angle can be increased as necessary on final approach to the chosen landing site by the use of wing flaps and side slipping the aircraft.

On the other hand, helicopters require little more room than the size of the aircraft for an unpowered, emergency landing. The helicopter can descend under control after engine failure in a condition known as autorotation, whereby the pilot decreases the pitch of the main rotor blades to allow them to be rotated by the air flowing upwards through the rotor blades. The spinning main rotor acts somewhat like a parachute and is capable of maintaining a near constant descent rate. The pilot retains full control and is able to select the most appropriate landing site. A few feet above the ground, the pilot flares the aircraft and increases the pitch of the rotor blades, which increases lift and slows descent just before ground contact to allow a gentle touchdown at little or no forward speed.

Sudden power loss of a fixed wing or rotary wing aircraft close to the ground on departure or landing is a different story, as in either case there is usually much less time to react and fewer choices in where to put the aircraft down. Most fatalities to do with sudden power loss (single or twin engine fixed or rotary wing aircraft) occur in this flight regime.

Generally speaking, the environment that most fixed wing aircraft operate in is quite different from that of helicopters. Helicopters, by their very nature as a vertical takeoff and landing aircraft are typically used to fly in and out of areas other than an airport. This means they often operate in difficult remote environments and should be considered differently from fixed wing aircraft.

Flying single engine aircraft over water, mountainous terrain and remote regions of the country is a normal daily occurrence in the operations of the RCMP Air Service and if an inflight enroute engine failure were to occur, the choice of a safe landing spot is diminished in comparison to operations in the prairies or populated areas of eastern Canada.

In the interviews conducted in the course of this project, the subject of safety in single engine versus twin engine helicopter operation came up the most in east coast helicopter operations due to the vast expanse of water in that region (Bay of Fundy, enroute between the Maritimes and Newfoundland) and more so on the west coast where there is not only vast amounts of water along the coast to contend with but high mountainous terrain and remote, heavily forested regions.

An RCMP AS350-B3 helicopter C-FMPG crashed on takeoff at Cultus Lake, BC on January 17, 2012 with only the pilot on board. The helicopter was destroyed and the pilot was fatally injured.

Findings of the Transportation Safety Board of Canada (TSB) were released in their report A12P0008 on March 12, 2014. The TSB findings as to cause and contributing factors are contained on page 33 of the report. In summary the findings makes reference to heavy snow falling while the helicopter was on the ground and that protective covers for the airframe and engine air intake were not installed and removal of the accumulated snow from the airframe or air intake was not carried out per the Flight Manual prior to flight. Water accumulated in the engine air intake system, and ice or compacted snow built up in the engine air intake plenum after start. The helicopter experienced a complete loss of engine power after liftoff resulting from a sudden change in air/fuel ratio caused by ingestion of the contaminant. The loss of power occurred at an altitude and airspeed that did not permit autorotation, which led to a rapid loss of main-rotor rpm, an extremely high rate of descent with reduced effectiveness of the flight controls leading to impact with the terrain.

It is important to note that the cause for the loss of engine power **was not** a mechanical failure of the engine or any other mechanical part of the helicopter.

The TSB report lists a number of Safety Actions taken by the RCMP following the investigation and they are listed on page 35 of the report.

Also contained in the TSB report is reference to the helicopter manufacturers Flight Manual (FM) which addresses the Airspeed-Height Envelope (AHE) that would allow for safe autorotation in the event of an engine failure with flights outside this envelope. The AHE is not a limitation but is in the FM to identify those low and slow flight regimes which present the greatest risk in the event of an engine power loss.

It is common for single engine helicopter operators to carry out Human External Transportation Systems (HETS) operations which involve transporting a person on a long line (about 100 feet) hanging below the helicopter. This is used in rescue situations or in the case of the RCMP, inserting

or extracting a member in to or out of a confined area. Transport Canada (TC) considers this operation to be a Class D external load.

Carrying out HETS operations involves placing the AS350 helicopter in the danger area of the AHE envelope where safe autorotation in the event of an engine failure is not likely.

Class D operations require the operator to use a multi-engine helicopter that is capable of hovering with one (1) engine inoperative. However, TC has granted exemptions to single engine operators for the purpose of law enforcement, rescue and firefighting.

The TSB findings point out that the pilot neglected to follow Flight Manual procedures and remove accumulated snow from the airframe and engine air intake before flight and this omission became the principal cause for the loss of engine power. It is purely speculative to consider if the outcome would have been any different in the same scenario with a twin engine helicopter where a double engine power loss could or could not have happened.

An internal RCMP document entitled "Rationale and Information Brief, Replacement Helicopter for E Division" dated 2014-06-05 was prepared and submitted by Insp. Nigel Bushe OIC E Division Air Services and CM Pilot Roger Thomson i/c Langley Air Services, supported by Supt. Gary Shinkaruk, OIC E Division Support Services Branch and recommended by C/Supt. Rosemary Abbruzzese, DCROPS E Division Policing Support Services.

This document is very thorough and makes reference to the 2012 accident and TSB report. The justifications in this internal document for a multi-engine helicopter go beyond the need for a wider safety margin when carrying out HETS operations but also address numerous limitations of the AS350 within the operations of E Division. The primary purpose of this report was to recommend the use of a multi-engine helicopter for E Division.

Providing the demands for the missions stated in the justification paper can be validated, it is the consultant's opinion that the conclusion contained in the report recommending a multi-engine helicopter is reasonable and the rationale for a used EC145 helicopter is also sound. If the RCMP is to have an orphan helicopter type, it should make every effort to ensure the different type belongs to the family of helicopter it already possesses to reduce aircraft operating costs.

This would provide the most cost effective solution and as stated in the report, provide a lower operating cost than procuring a helicopter from a different manufacturer. This endorsement is mainly based on the operational requirements of the helicopter, based on the stated demands from the Division than an argument for the safety of a twin engine helicopter for all the cases.

In conclusion, it is our professional opinion, that the RCMP operates a fleet of relatively new aircraft that are very well maintained and flown by experienced and well trained professional pilots. There is nothing unique about the RCMP fixed or rotary wing operations / missions in comparison to other fixed or rotary wing operations (commercial or private) flown by professional pilots.

In the final analysis, it becomes the operators' decision as to the extent they wish to go to mitigate some of the risks of flying with consideration for cost, operating effectiveness and public opinion.

13.3 Comparable Aircraft Platforms

For each of the aircraft currently in inventory with the RCMP, a few alternate solutions are being proposed based on the wishes that have been highlighted during the interviews or based on industry's practices and on experience and knowledge of the market.

The details of the comparable aircraft are presented in Annex H with as many details as possible and available for the purposes of comparison.

In summary, the comparison was performed under four (4) categories of operation as per Table 7.

Table 7 - Aircraft selected for capability comparisons

Role	Aircraft Type
Larger transport aircraft	Pilatus PC-12 Beechcraft King Air 350ER De Havilland Dash 8-100
Surveillance aircraft/Small transport aircraft	Cessna 206 Cessna 208 Diamond 62 (MPP) Quest Kodiak 100
Other (could fit under transport aircraft)	De Havilland DHC 6-300 (Twin Otter)
Helicopters (surveillance and transport)	EC120B AS350 B3 EC135-T2 EC145 Bell429

13.4 Analysis criteria

In reviewing the options a number of criteria were applied in assessing how exiting aircraft and potential replacements were appropriate. These criteria are those that seem the most relevant to consider. The following criteria were used for the analysis and are listed in order of importance:

a. Operational capability: This is the key element in the selection of the appropriate aircraft to be selected to perform a given role and mission. Each aircraft is being assessed on how well the aircraft is meeting the perceived operational requirements as well as the frequency those requirements are expected to be met. This criteria is being assessed by the consultant based on the interviews conducted and the data gathered to substantiate them;

b. Dispatch Reliability: It is the percentage of aircraft planned departures/launches that leave at the specified time in accordance with the master operational plan. Is the aircraft ready to fly when it is expected to do so? This criteria was unable to evaluate as no such data is recorded by ASB;

c. Risks/Safety: The aircraft being flown all meet the airworthiness authorities' standards and regulations and are all inherently equally safe to fly. However, the conditions of operations may add an additional element of risk and/or safety concern to the operation and its crews;

d. Aircraft Commonality: Aircraft commonality provides an inherent reduction on the aircraft operating cost that is important. A common aircraft reduces training cost and the cost of remaining current. It also provides a reduction of maintenance coast and of aircraft spares required to keep in inventory. Additionally it provides interoperability across the force allowing pilots to be moved more easily to augment other regions in times of need. These elements help to ensure a cost effective and safe operation;

e. Operating cost: This is the variable cost that is required to operate and maintain the aircraft airworthy and ready to fly. It is a measure of the life cycle cost of the aircraft and an element that needs to be tracked to observe any changes that would indicate the increasing cost of an aging fleet. There is no information being tracked to provide such information at this time. Information such as actual cost per flying hour or number of unscheduled maintenance hours per flight hour;

f. Procurement cost: The actual cost of aircraft replacement. This should not be the overriding factor in the decision-making process as the above criteria weigh more heavily than the selection of a new aircraft. However, it is a factor that needs to be considered; and

g. Environmental considerations (gas emissions and noise): There is a trend in aviation led by governments to reduce noises and greenhouse gas emissions. Commercial operators have all adopted programs along those lines and it is felt that government organizations involved in aviation should take this into consideration as presented in **Annex I**.

ASB is a service provider to the RCMP and as such has to have a clear mandate to ensure it provides the expected service. If the RCMP had clear Statements of Requirements and Performance that were based on well documented facts it would make sense to use a quantitative approach and give a weighting factor for each of the selected criteria. Such information was requested but not available. The actual performance metrics that would be needed to perform a complete needs and demands analysis will be presented in the Performance Metrics section. However, here are some elements that would be key indicators: frequency of sorties of various mission types and establishment of distance, time and payload requirements for each of the categories for each aircraft type. Consequently, the aircraft assessment as meeting the needs and demands of the RCMP has to be performed using a more qualitative approach.

The following is a generic statement and will be developed further in the next section. Average sortie lengths were provided and all fell into the capable limits of the aircraft that were used to fly

those missions. Without context or without an understanding of the actual demand at the time the sorties were requested, the only conclusion that can be drawn is that the aircraft currently in inventory are adequate for RCMP operations.

As there was no data to demonstrate any changes in the flying patterns over the last few years, it is difficult to assess if the fleet limitations perceived by the operators is based on old expectations or current ones. There are still beliefs among some personnel that the RCMP should be responsible to provide for the movement of Furniture and Effects on members' transfers. This is obviously no longer the case and not a role the RCMP wants to pursue for a variety of commercial and legal reasons.

13.5 Assessment of the Optimal Fleet Composition

Each aircraft type has been reviewed and compared against the selected criteria for evaluation. The analysis has been carried out keeping in mind the comparable aircraft that could be used to perform similar duties. The information is presented in five (5) segments each representing as best as possible the broader roles of ASB. The analysis is presented in the form of tables summarizing the consultant's observations.

13.5.1 Fixed Wing aircraft assessment

Larger Transport Aircraft/High Altitude Surveillance

Table 8 - Aircraft Comparison - Larger Transport/High Altitude Surveillance

Criteria/Aircraft	Pilatus PC12	Beechcraft King Air 350ER	De Havilland Dah 8- 100
Operational Capability	Transport: In the transport role, based on the data reviewed and available, it is concluded that the aircraft can easily fulfil its role at an approximate 80%-85% of the requirements. It is capable of landing on unprepared surfaces of runways that are less than 2000' in length. HAS: The aircraft performance as a high altitude surveillance platform has proven to be very effective.	Transport: This would allow a full complement of basic ERT team to be transported on the odd time that it is required. It also has increased speed over the PC12. HAS: There are no measurable advantages to having this aircraft for surveillance except for the increased aloft time.	Transport: This would allow a full complement of 17 ERT team to be transported on the very few times (based on gathered information, this would be fewer than five (5) times a year) that it is required. It also has increased speed over the PC12. HAS: There are no measurable advantages to having this aircraft for surveillance except for the increased aloft time.
Dispatch Reliability	No available data. But it has been renowned to have a very high dispatch reliability rate.	No available data. But it has been renowned to have a very high dispatch reliability rate.	No available data. But it has been renowned to have a very high dispatch reliability rate.
Risks/Safety	The aircraft is a single-turboprop engine. The PT6 is one of the most reliable engines made. The aircraft has a very good reputation among commercial operators.	A twin-engine aircraft provides an implicit level of safety. However, there has not been significant indications that the number of incidents is fewer than with the single-engine PC12 which has become the industry standard.	A twin-engine aircraft provides an implicit level of safety. However, there has not been significant indications that the number of incidents is fewer than with the single-engine PC12 which has become the industry standard.

Criteria/Aircraft	Pilatus PC12	Beechcraft King Air 350ER	De Havilland Dah 8- 100
Aircraft Commonality	ASB has a total 16 PC-12. Although there are differences in the configuration of legacy aircraft and the newer PC12, this allows economy of scales and procurement power for training and parts. The aircraft is still in production and can continue to be procured.	No other aircraft in the RCMP inventory and this would be an orphan unless many were purchased and that the whole fleet was eventually replaced by King Air 350s. The aircraft is still in production and can continue to be procured.	This aircraft would only be acquired in a limited number of one (1) or two (2) if it was deemed appropriate and hence it would be an orphan. The aircraft is no longer in production and the Q-400 is too big and too expensive an asset for RCMP requirements.
Operating Cost	The operating cost is 40% less than the King Air and even less than the Dash-8. This is due to reduced fuels consumption, reduced engines maintenance cost, reduced maintenance hours due to only one engine.	Higher operating cost than the PC12 by an order of 40%. The two engines require twice the overhaul and maintenance costs. It does require more maintenance hours to keep airworthy.	In addition to the two engines, the aircraft is a two-pilot operation and would require a significant change in the RCMP structure.
Procurement Cost	One third of the procurement cost of a King Air 350.	Three times the procurement cost of a PC12.	New Dash-8s come in the form of the Q400. Their procurement costs can be as much as ten (10) times that of a PC-12. Leasing or purchasing an older version of the Dash-8 can be more attractive.
Environmental Considerations	A newer aircraft with new environmental standards taken into consideration by the engine OEM.	A newer aircraft with new environmental standards taken into consideration by the engine OEM.	An older aircraft with older engines that may not have the same environmental considerations.

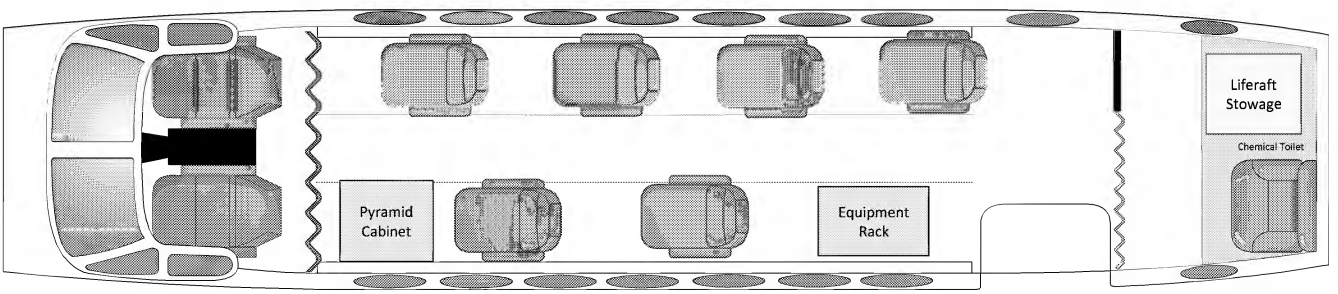
Without prejudice to the conclusions of this report, it was felt to be worthy to note that after 9/11, the newly formed US Department of Homeland Security (DHS) Customs and Border Protection (CBP) reviewed the situation with their fleet of ISR fixed wing aircraft used for surveillance and border protection. After analysis they decided to acquire a fleet of thirty (30) Bombardier Dash 8 aircraft. After taking delivery of seven (7) Dash 8's, Bombardier ceased production and did not fill the remaining orders. This forced CBP to choose an alternate aircraft. They selected the Beechcraft

King Air 350ER aircraft taking delivery of a total of 25 KA350ER's. The mission parameters used in the DHS procurement decision are unknown and although it is difficult to draw any specific conclusions, it was felt worthy of mention.

King Air 350ER

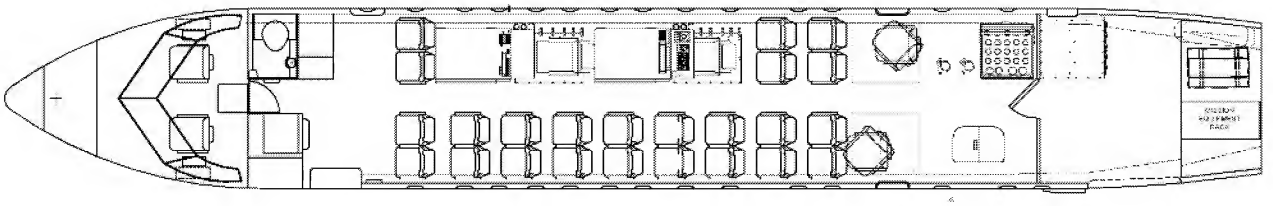
Following is a sample of a King Air 350ER cabin arrangement for ISR or troop transport purposes.

ERT Transport Interior



Bombardier Dash 8

Surveillance / Transport Combination Interior



Use of a Dash 8 (100/200/300 series) for this purpose was suggested by various ASB personnel and there is no doubt it would meet the carrying capacity of a full ERT if this was a requirement. In addition, there are a number of existing ISR special mission mods for the Dash 8 that could be incorporated in the aircraft giving it a multi-purpose role and better utilization.

To better understand the Dash 8 option, we have included a document (Annex K herein) prepared by Field Aviation, a major Canadian Dash 8 mod facility specializing in the Dash 8. This Feasibility Proposal uses a Dash 8 – 300 Series aircraft but could apply to a 100 or 200 series as well. In addition, given the high capital expenditure of such an aircraft acquisition, a Lease Proposal is also included in the document. The purpose of including this option within this report is to provide ASB with an understanding of alternate options to their existing fleet that can be used in their final analysis.

Conclusion: From the information available and the understanding of the operational requirements. It appears the PC12 is a suitable aircraft for the role in which it is employed. It is a reliable aircraft with low operating costs that can meet 80% to 85% (conservative, this is probably more) of the

operational requirements of the RCMP. In addition, this has become a cost-effective industry standard for this type of operation.

Potential Consideration: When ASB has gathered the required data and can objectively state its requirements, it is possible that a reasonable option is to procure one (1) or two (2) aircraft to be strategically positioned across the country to be ready for the occasions (if they are sufficient) that a larger aircraft is required. But before this is done, considerations have to be given to having standing offers in place with commercial operators to satisfy these demands. This needs to be done in a deliberate fashion across the board to ensure maximum flexibility and operations responsiveness.

Smaller Transport Aircraft/Lower Altitude Surveillance

Table 9 - Aircraft Comparison - Smaller Transport/Lower Altitude Surveillance

Criteria/Aircraft	Cessna 206	Cessna 208	Diamond DA-62 MPP	Quest Kodiak 100
Operational Capability	The piston version of the aircraft has a noise signature higher than its turbine counterpart and this poses some problems for flying operations at a lower altitude where it is likely to operate The turbine version performs its role well and has a lower noise signature positively contributing to the mission. This is not a transport aircraft and payload is not as much of an issue.	There are two types of operations for the Caravan. One transport aircraft in Prince Rupert and two in Montreal In the passenger carrying and faced with west coast operations, requiring good instrument flying capability, a good payload for transporting passengers along the BC coast and capable of floats landings. For its role, the aircraft has a spacious cabin, with good space to transport the TFO and additional personnel to support operation. For the whole region of Quebec this a/c may	This is a reasonably new aircraft on the market. On paper it has the same endurance as the C208 and more endurance than the C206. The cabin size is slightly bigger than the C206 but not quite as spacious as the C208. In its Multi Purposes Mission configuration it is capable of carrying an	This is a relatively new aircraft in production for the last 10 years with over 100 sold. It is already in the RCMP inventory. On paper the aircraft has better payload, speed and endurance capabilities than the C206 but 20% lower payload than the C208. this aircraft could replace both the C206 and C208. The aircraft has STOL capability and can operate amphibiously. As a passenger aircraft it could be more

Criteria/Aircraft	Cessna 206	Cessna 208	Diamond DA-62 MPP	Quest Kodiak 100
		have too small an endurance. It is labelled as a lower altitude aircraft if higher altitude is an RCMP requirement, then this aircraft may not meet the requirements.		restrictive than the C208 in terms of the maximum number of passengers with full fuel. version already exists.
Dispatch Reliability	No available data. The piston version is more than likely more problematic than the turbine version which arguably has a higher dispatch reliability rate.	No available data. This being a turbine aircraft is expected to have good reliability. The only concern that needs to be validated is the corrosion impact is any.	No available data.	No available data.
Risks/ Safety	The piston engine version of the aircraft arguably has a lower reliability than the turbine aircraft. On the safety issue, the TFO position needs to be addressed which will be a challenge given the size of the cabin. The maximum height of the cabin is 49.5 inches. This is a real concern.	The aircraft is a single-turboprop engine. The PT6 is one of the most reliable engines made. The aircraft has a very good reputation among commercial operators.	There is no history on this aircraft. It is a piston diesel engine aircraft propelled using jet fuel. This is a twin engine aircraft and should implicitly provide higher level of safety.	There is little history on this aircraft. But this aircraft is equipped with a PT6A engine with a very good safety record. It has a larger cabin than the C206 which would take away the safety issue with respect to the position of the TFO. It is slightly smaller than the C208 but with a cabin height that is higher. Hence a good candidate as well.
Aircraft Commonality	There are four (4) 206 aircraft in the RCMP	There are three (3) Cessna 208 in the	No other aircraft in the fleet but	There is already one aircraft in

Criteria/Aircraft	Cessna 206	Cessna 208	Diamond DA-62 MPP	Quest Kodiak 100
	inventory. This is good in terms of commonality. However, within the 206 family, the Soloy is really a different aircraft.	fleet. This is good in terms of commonality but this could be improved to have even greater commonality if possible.	could be a good surveillance aircraft to replace both the C206 and C208.	the fleet and this could be a good aircraft for the surveillance roles
Operating Cost	Information on piston aircraft is difficult to obtain. The projected operating cost is not available. However, based on discussions with maintenance personnel within ASB, it has been observed that the aircraft maintenance efforts have increased in recent years.	The operating cost of the Cessna 208 is similar to the Kodiak and 25% lower than that of the PC12.	Operating cost is unknown. However it has two engines and this can potentially raise the operating cost. It has a very low fuel consumption in comparison to the other aircraft in this category and uses less fuel than the C206.	Operating cost is lower than the C208.
Procurement Cost	One of the few aircraft with a procurement cost under one million USD.	A procurement cost that is lower than PC12.	Marginally more costly than the C206 but half the price of the C208.	The procurement cost is about half way between the C206 and the C208.
Environmental Considerations	The piston version is already facing issues with being able to get Avgas. In the future, although the FAA is looking for replacement options, a piston aircraft being operated in a quasi-commercial operation is not ideal.	These aircraft are getting a little older in age and they may benefit from rejuvenation in terms of gas emissions.	Newer engines operating with Jet fuel, this should have a positive environmental footprint. Potentially noisier than turbine aircraft.	New turboprop built with the latest environmental standards applied.

Conclusion: There are a number of issues to be considered in this analysis.

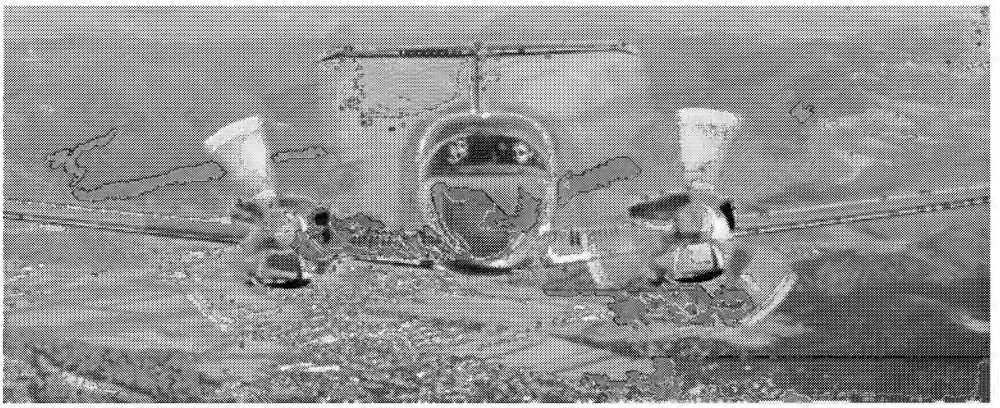
Surveillance – For surveillance, the C206 is already in inventory and is not a very old aircraft however, it poses a safety issue due to the ergonomics associated with the head clearance for the TFO operating the camera system. The piston engine aircraft is not a very good low altitude

asset as it produces about twice the noise level as its counterpart turboprop Soloy. Nevertheless, and assuming that the lower altitude role is required, the following approach is recommended:

a. It makes sense to continue the approach initiated by ASB to investigate a solution to modify the aircraft to meet ergonomics standards and ensure the safety of its crew. Soloy has modifications available for the C206 to improve its cabin for the mission system operator (seat and headliner) and could be available to the RCMP without converting the engine;
b. Investigate the Soloy conversion for the piston engine powered C206s;
c. Assess the cost of performing the above mentioned steps and compare with the procurement of an alternate asset that could provide a higher degree of commonality with RCMP assets.

The use of a piston engine aircraft is less desirable for an operation as the RCMP and preference should be given to turbine engines which tend to be much more reliable.

However if the RCMP felt that a piston aircraft would be appropriate it would be wise to consider the twin engine piston diesel powered DA62 MPP which operates using Jet fuel. This aircraft offers all of the advantages of the turbine powered solutions but at a much reduced acquisition and operating cost. See Annex L herein for more information on the DA62 that was requested to Diamond Aircraft.



This has to be ascertained by the RCMP.

PC12 (aircraft commonality) be procured. This would mean having at least in the fleet (depending on the demand for the air asset, more aircraft could be considered) that would be minimally located strategically across the country to ensure there is a nearly complete coverage of the country for HASP. Aircraft would be located in the following bases:

1. Vancouver: This would ensure coverage of most of BC and Alberta;

2. Winnipeg: This would ensure coverage of most of Saskatchewan and all of Manitoba;
3. London: This would cover the whole of Ontario; and
4. Montreal: This would cover Quebec and would cover most of the Maritimes, including Newfoundland when the situation requires it.

Passenger Transport – The Kodiak being operated out of Prince George has been used for limited transport and for Search and Rescue. It performed adequately for the time it was actually flying but has been out of service for over a year due to damage to the aircraft.

For this category, there is one role that has not been addressed and that is the transportation of passengers and cargo from Prince Rupert. They have a Caravan (C208) on floats. Based on the missions being performed, the aircraft seems to meet most of the requirements in terms of passengers, payload and endurance. IFR flying is limited based on the pilots at the base. There are also concerns about aircraft corrosion. The aircraft is being maintained in accordance with the manufacturer's maintenance program which also includes a Corrosion Prevention Control Program. However, it has been reported that the aircraft will soon no longer by maintainable. The following approach is recommended:

5. The corrosion of the aircraft should mapped for the whole aircraft by taking exact measurements of size of the damage and remaining thicknesses;
6. Measurements of the corrosion areas of concerns should be compared with OEM tolerances and forwarded to the OEM for evaluation;
7. Depending on the outcome, get an estimate for a major corrosion overhaul, if required, and request changes to the existing corrosion prevention and control program (CPCP). Corrosion on an unpressurized aircraft may be repaired and monitored using an effective CPCP. Assess both the economic and airworthiness concerns;
8. If the resulting business case shows that it is no longer economical to keep the aircraft in the fleet, then the replacement options are either to replace the aircraft with a similar aircraft. If it can be demonstrated that a bigger payload is required, then consideration for the Grand Caravan. Otherwise, depending on the decision for the other surveillance aircraft, select another Caravan or a Kodiak in line with the commonality requirements. Both aircraft operate on float and with the newer version, they are fully IFR certified with glass cockpit.

Potential Consideration: For the purpose of providing close surveillance coverage of an on-scene situation, there should be consideration given to operating a number of Unmanned Aerial Systems (UAS). The UAS should be under the technical council of ASB for training, implementation and approvals from Transport Canada but they should be deployed with the ground assets to provide them with the required flexible support.

Special Case Transport Aircraft

Table 10 - Aircraft Comparison - Special Transport

Criteria/Aircraft	De Havilland Twin Otter	C208B Grand Caravan EX	Pilatus PC-12
Operational Capability	The Twin Otter is particularly suited to perform the duties associated with the Labrador terrain and water combination. It has STOL capability allowing the aircraft to land on short unprepared landing strips. It has a very good payload capability and a reasonable endurance.	This aircraft could be a potential replacement meeting most of the harsh conditions and comes with amphibian floats if required. It is possible to install a STOL kit to allow the aircraft to land on short unprepared landing strips. It would have less seating capability than the Twin Otter but with a similar payload. Data would be required to verify this statement but it is believed that this aircraft would provide at least an 80% solution.	PC12 couldn't do the work. Very short unpaved landing strips.
Dispatch Reliability	No data available. Although a latest engine problem has forced the aircraft to be out of commission for a long period.	No data available.	No data available
Risks/Safety	This aircraft has shown no safety or risks issues to personnel. It is equipped with a very reliable PT6A engine.	This aircraft has shown no safety or risks issues to personnel. It is equipped with a very reliable PT6A engine.	This aircraft has shown no safety or risks issues to personnel. It is equipped with a very reliable PT6A engine.
Aircraft Commonality	This is a fleet orphan that poses its own problems	Having at least two Grand Caravan in the fleet would be beneficial, both operationally and in terms of fleet commonality (one in	In terms of commonality this would be the best fit.

Criteria/Aircraft	De Havilland Twin Otter	C208B Grand Caravan EX	Pilatus PC-12
		Prince Rupert and one in Goose Bay)	
Operating Cost	The operating cost could not be established. However, it has twice the number of maintenance hours per flight hour than the Caravan and the PC12	This would be something to consider if the aircraft started showing signs of aging.	This would be something to consider if the aircraft started showing signs of aging.
Procurement Cost	This aircraft is being leased. But a new Twin Otter would be twice as much as the Grand Caravan or the PC12.	Half the cost of the Twin Otter.	Half the cost of the Twin Otter.
Environmental Considerations	This is an old aircraft with both Gas emission and noise issues.	Newer technologies with gas emissions and noise footprint meeting the latest regulations.	Newer technologies with gas emissions and noise footprint meeting the latest regulations.

Conclusions: The Twin Otter is at this time the best aircraft to meet the operational requirements associated with the harsh climates and conditions of that part of the country. However, once data starts being tracked and it becomes necessary to replace the aircraft, then the Grand Caravan EX seems like an acceptable compromise for replacement at half the price of the Twin Otter.

13.5.2 Rotary Wing

Surveillance Helicopter

Table 11 - Helicopters Comparison - Surveillance

Criteria/Aircraft	EC120B/H120	H 135T2
Operational Capability	A widely used helicopter for city surveillance	
Dispatch Reliability	No available data.	No available data
Risks/Safety	The aircraft is powered by a turbine engine which has shown to be very reliable when operated within the OEM parameters.	Increased safety given it has two engines. However, both engines power the same tail rotor and the same transmission which probably more likely to be subjected to a mechanical failure than the engine itself.
Aircraft Commonality	Already in the fleet	Would be an orphan unless a pair was procured.
Operating Cost	Almost half the operating cost of the EC135.	Almost double the operating cost of the EC120B.
Procurement Cost	Very affordable at around 2M USD	Almost three (3) times the cost of the EC120B.
Environmental Considerations	Newer technologies meeting more recent environmental considerations	Newer technologies meeting more recent environmental considerations

Conclusion: The current EC120B is a very good fit for local surveillance when equipped It is a reliable helicopter used by many police forces in the world to patrol cities. It has a low procurement cost and low operating costs. It does have limited capability for transporting personnel and it has to be determined to what extent this is a requirement.

Other Considerations: Reviewing the ERT data provided by the RCMP Policy Centre, indications are that the EC120B would have been the perfect asset if the aircraft had been available. Reasons for non-availability are unknown and should be investigated before replacement options are being considered. As an indication of aircraft availability, the Edmonton Police using the same helicopter performs twice the annual flying rate than the RCMP. The Edmonton Police has a clear statement of performance to meet making it easier to determine the right staffing level

Transport/Surveillance Helicopter

Table 12 - Helicopters Comparison - Transport and Surveillance

Criteria/Aircraft	Eurocopter AS350B3/H125	Airbus H145	Bell 429
Operational Capability	Based on the data provided this meets over 85% of the requirements for which the consultant has received data.		
Dispatch Reliability	No data available data.	No data available data.	No data available data.
Risks/Safety	This is a turbine engine powered helicopter with a very good safety record. It has become the industry standard for most of the aerial work performed by commercial operators.	Increased safety given it has two engines. However, both engines power the same tail rotor and the same transmission which probably more likely to be subjected to a mechanical failure than the engine itself.	Increased safety given it has two engines. However, both engines power the same tail rotor and the same transmission which probably more likely to be subjected to a mechanical failure than the engine itself.
Aircraft Commonality	There are already six (6) helicopters of this type in the RCMP inventory. It is definitely an asset.	This would be an orphan unless the whole fleet was to be converted. Arguably having this helicopter manufactured by Airbus would be less of a penalty.	This would be an orphan unless the whole fleet was to be converted. Additionally, this helicopter is being manufactured by Bell and would have little commonality with Airbus assets.
Operating Cost	The operating cost for this helicopter is about 456 USD per flight hour.	The E145 has approximately double the operating cost of the AS350. This is also a single pilot operated helicopter.	This helicopter has about 50% higher operating cost than the AS350. This is also a single pilot operated helicopter.
Procurement Cost	Approximately 2.6M USD.	Almost three (3) times the cost of the AS350.	Almost three (3) times the cost of the AS350.
Environmental Considerations	Newer technologies meeting more recent environmental considerations	Newer technologies meeting more recent environmental considerations	Newer technologies meeting more recent environmental considerations

Conclusion: Based on the analysis and the data provided, this helicopter is well suited and provides a very good ratio of cost versus performance for the surveillance role and transport requirements of the RCMP. There are some questions to be considered for flying over large areas of water.

Other Considerations: E Division has made a case for the procurement of a twin engine helicopter (a used EC145) on the basis that it had a requirement to transport a larger contingent of personnel on a sufficiently frequent basis. If that is the case and there is data to substantiate the business case, it is supported in this report. If the demands are documented and warranted this is reasonable. If the demands are in the order of 20% or less, the better solution might be different.

14 Evaluation of the Optimal Replacement Cycles

The optimum aircraft replacement cycle would be greatly associated with increased operating costs, residual aircraft value at the time of disposal and reduction of aircraft dispatch rate. Neither of this data is available for evaluation. One element that was added to this study that is not intrinsic to the mandate is the Government of Canada's commitment to reduce Gas Emissions in the coming years. It has stated that gas emissions would be reduced by 17% b 2020 in comparison to the 2005 emissions. Also the government has exerted significant pressure on commercial operators to take actions that will go into this direction. For example, Air Canada has proceeded with the replacement of some of their aircraft and has made significant aerodynamic modifications (installation of winglets) on others to reduce their environmental footprint.

Although not a hard requirement, it is believed that as a government organization, the RCMP should include such a consideration when selecting the timing for a replacement aircraft and the actual choice of the aircraft.

As stated, the decision to replace or not replace an aircraft is based on a number of factors and one of them being the aircraft operating cost over a 20 year period. Given that this is the only parameter available, the analysis will be performed on the basis of this information. In the end, there are three (3) options that may remain as a conclusion:

a. Extend the life of existing aircraft;
b. Replaced by purchased assets; or
c. Replaced by leased assets.

14.1 Analysis basis

The main driver behind selecting an aircraft has to be based on operational requirements. Once these criteria have highlighted a number of options, then, among other elements, financial considerations are used to determine the best replacement schedule. As such, when replacing aircraft, RCMP is normally seeking minimum capital cost solutions in the acquisition phase while ensuring this philosophy doesn't have adverse effects on long-term operating costs. The decision to select an asset or to maintain its use within the organization has to be based on the overall picture which includes acquisition, operating and disposal cost.

The purpose of this analysis is to forecast the maintenance requirements of the RCMP fleet over a 20-year period with the aim of identifying the aircraft that will be requiring the most maintenance attention and could become a burden for the RCMP to maintain. By determining the schedule and the associated costs for all the major maintenance requirements: major inspections, overhauls and life extension program; the present analysis will generate metrics against which to compare the purchasing and operating cost of new aircraft in replacement of the old assets.

14.2 20-year Life Cycle Management Cost

20-year maintenance costs projections will be one of the evaluation criteria used in the present study to assess overall fleet condition.

14.2.1 Assumptions

Here's a brief list of the assumptions used for our projections.

Exclusions: The following elements were excluded from the cost analysis.

- Replacement of time limited parts, components, supplies and material were not included. The review of the Chapter 5 manual for the different aircraft has led us to conclude that none of the parts/components scheduled replacement will carry a high price tag. The only exception was for the replacement of main rotor blade for the Airbus Helicopter AS350B3. This cost was included.

- Annual inspections, daily/routine checks and other scheduled maintenance costing less than $25,000 were not included in the forecast. These costs do not vary greatly whether operating a brand new or a used aircraft. Therefore, as these costs do not fluctuate with the age of the aircraft, they were not factored into our calculations.

- Unscheduled maintenance data (labor and parts) for the RCMP fleet was not available. Occurrence of unscheduled maintenance items increases progressively with the utilization of any aircraft leading to significant additional maintenance costs. For future analysis, such costs items should be part of the evaluation.

Inclusions: The following elements were included in the cost analysis

- Engine overhaul

- Main rotor blade replacement (Rotary Wing aircraft)
- Major Inspections – 10 year, 12 year
- Life Extension Program

Time Before Overhaul (TBO) for each tail number was estimated with actual flights hours.
A 2% annual cost inflation was applied to all 2016 maintenance costs projections.

14.2.2 Findings and Observations

The following maintenance charges were used in our 20-year projections. Representing the largest ticket items, these charges were part of our analysis to determine the total costs that will need to be incurred by the RCMP to maintain its fleet. Overhaul of the propeller and other non-major maintenance checks were dismissed as they do not require large monetary commitments (less than $25,000 for the most part). In some case, the information required was not available and appropriate assumptions were made to account for major inspection efforts.

Table 13 - Maintenance Schedule and Cost Estimate per Aircraft Type – Major Inspections and Overhaul

Aircraft Type	Model	Major Inspection Schedule	Cost	Overhaul - engine	Cost Estimate
Airbus Helicopters	B3	*12 years*	$500,000	Every 3,000	$314,000
Airbus Helicopters	EC-120B	*12 years*	$500,000	Every 3,000	$314,000
Cessna	208	*No major inspection*	N/A	Every 7,500	Between $125,000 to $400,000
Cessna	T208H	*No major inspection*	N/A	Every 1,700	$115,000
De Havilland	DHC6-300	*No major inspection Equal Maintenance for Maximum Availability Program*	N/A	Every 7,500	Between $125,000 to $400,000
Kodiak Quest	K100	*No major inspection*	N/A	Every 4,000	Between $125,000 to $400,000
PC-12	45/47/47E	*No major inspection*	N/A	Every 5,000	Between $125,000 to $400,000

*Note: The two Cessna 210 will be sold and have not been included.

Only the two Airbus Helicopters models (B3 and EC-120B) are requiring as per the manufacturer's manual a major inspection every 12 years for a cost of $500,000. The other aircraft models – 208, T208H, K100, and the PC-12 – do not have large inspections requirements in their maintenance services bulletins. These aircraft are undergoing regular maintenance services that are often performed in parallel with the annual inspections limiting the time the aircraft needs to be grounded

for shop time. The Cessna 208/T208H, the Quest K100, the DCH6-300 and the PC-12 are very robust and reliable fixed-wings aircraft renowned for being not economical to maintain. The review of the maintenance manuals has allowed us to determine that no major inspections requiring large amount of capital were scheduled for those aircraft.

In addition to the major labor maintenance charges listed in the previous table, a review of the maintenance manuals, especially Chapter 4 and 5, was also performed to determine time limited items on expensive components and the services bulletin required to maintain airworthiness of the asset (Life Extension Program).

Table 14 - Time Limits Items – Rotor, Wings and Life Extension Program

Aircraft	Major Time Limits Items / Life Extension Program	Time Limits	Cost Estimate	(Number) and tails # affected in the next 20 years
EC-120B	Rotor blade replacement	20,000 hrs	$162,000 USD / $212,220 CND*	None
B3	Rotor blade replacement	20,000 hrs	$162,000 USD / $212,220 CND*	(1) C-GMPN
PC-12	Life Extension Program	20,000 hrs	$275,000 USD/$360,250CND*	(8) C-FMPF C-GMPM C-GMPE C-GMPV C-GMPP C-GMPY C-GMPX C-FMPB
DHC6-300	Wings replacement	66,000 hrs		None – C-GMPJ has only 33,000 logged hours.

*Exchange rate of 1.31 CDN/USD was used.

Out of the 34 aircraft comprised in the RCMP's fleet, only one (1) aircraft will have to replace some major components within the next twenty years: C-GMPN (AS350B3). The due date for the replacement of the main rotor blade every 20,000 hrs is scheduled for 2033. Various smaller components and parts will have their airworthiness limitations date expire within the 20-year period, but due to the limited replacement cost these costs were not included in our forecast.

The PC-12s have to undergo a first major tear-down inspection at 20,000 flight hours or 30,000 landings. Engineers are looking for corrosion and wear and tear to doors and frames, flight control systems, and wiring, among other issues. If required, the engine and prop will be sent to an approved maintenance organizations for repair or overhaul. The service bulletin for this maintenance item costs $275,000 US ($360,250) and requires 100 days of shop time. In the next 20-years, our projections estimate that eight (8) – 50% of the PC-12 fleet – will have to receive a Life Extension Program inspection.

When taken separately, the costs for the major time limits items, overhaul and major inspections seem like big numbers, but when aggregated over a twenty-year period, the capital requirements to pay for these maintenance expenses can be supported by the RCMP. In the next section, we will present the 20-year maintenance costs projections for each RCMP aircraft with the objective to determine which tail numbers should be considered for replacement.

14.3 Aircraft Assets Management Strategy Replacing vs. Extending Life

14.3.1 General

The analysis shows that despite the fact that some of RCMP's aircraft are aging, scheduled maintenance requirements stay overall relatively manageable over the 20-year period. With only five (5) aircraft for which the cost of the major maintenance items – engine overhaul, major inspections, time limits, life extension program – are above the $2M mark, it is safe to assume that the RCMP fleet is comprised of low-maintenance aircraft.

Table 15 - Forecasted Maintenance Costs for RCMP Fleet – per Registration Code

Registration	Aircraft Type	Air Services Station	Mfg Date	Age	Total Flight Hours	Avg Annual flt hours	TOTAL Mtce Costs*
C-GMPN	Euro B3	Kamloops	1998	18	10,977	506	$3,146,129
C-FMPP	Euro B3	Edmonton	2006	10	5,714	602	$2,785,373
C-FMPF	PC-12/47	Prince George	2006	10	10,709	1,029	$2,362,653
C-FMPQ	EC-120B	Vancouver	2008	8	4,533	494	$2,239,776
C-GMPT	EC-120B	Vancouver	2004	12	6,931	533	$1,914,660
C-GMPF	Euro B3	Comox	2007	9	3,045	369	$1,881,287
C-GMPV	PC-12/47E	Iqaluit	2009	7	6,160	998	$1,865,141
C-FMPH	Euro B3	Moncton	2003	13	5,733	414	$1,823,376

Registration	Aircraft Type	Air Services Station	Mfg Date	Age	Total Flight Hours	Avg Annual flt hours	TOTAL Mtce Costs*
C-GMPE	PC-12/47E	Edmonton	2008	8	5,712	810	$1,588,598
C-GMPM	PC-12/47E	Moncton	2008	8	5,780	755	$1,517,093
C-GMPX	PC-12/47E	Yellowknife	2008	8	7,270	1,071	$1,469,006
C-GMPP	PC-12/45	Winnipeg	2001	15	15,351	900	$1,428,362
C-FGMQ	PC-12/47E	Ottawa	2004	12	3,476	376	$1,417,595
C-FMPB	PC-12/47E	Whitehorse	1999	17	10,521	537	$1,229,500
C-GMPY	PC-12/45	Edmonton	2000	16	12,038	680	$1,116,248
C-GMPO	PC-12/47E	Ottawa	2010	6	3,924	726	$992,277
C-FRPQ	Euro B3	Montreal	2002	14	3,589	127	$936,087
C-GMPK	Euro B3	Kelowna	2004	12	5,002	413	$753,833
C-GMPW	PC-12/47E	Regina	2012	4	1,431	538	$700,955
C-GMPB	PC-12/47E	London	2011	5	2,407	547	$673,736
C-FMPA	PC-12/47E	Prince Albert	2010	6	4,256	695	$672,551
C-GMPJ	DHC6-300	Goose Bay	1977	39	35,600	533	$667,002
C-GTJN	T206H	London	2004	12	1,448	285	$577,011
C-GNSE	T206H	Edmonton	2008	8	1,418	219	$432,560
C-GMPR	208	Prince Rupert	1996	20	7,517	402	$367,563
C-FSUJ	208	Montreal	1993	23	8,923	577	$332,913
C-GMPQ	PC-12/47E	Winnipeg	2011	5	2,094	376	$322,206
C-GMPA	PC-12/47E	Vancouver	2011	5	3,389	712	$291,832
C-FDGM	U206G	Vancouver	1985	31	14,069	229	$286,874
C-FDTM	T206H	Vancouver	2004	12	1,393	100	$161,028
C-FRPH	208	Montreal	1993	23	7,903	141	- $
C-FSWC	T206H	Regina	2004	12	753	14	- $
C-GMPI	Quest K100	Prince George	2011	5	550	147	- $
C-FMPK	PC-12/47E	Thompson	2008	8	4,723	649	- $

*Included in the 20-year maintenance cost projections: Major inspections, engine overhaul, major time limits components and life extension program.

14.3.2 Specific aircraft analysis

PC-12

The older aircraft (15+ year airframe) are also relatively cheap to maintain. Taking the PC-12 fleet for example, it will cost, for the three older aircraft – C-GMPP, C-FMPB, C-GMPY, between $1.1M and $1.4M over 20-years to cover for the engine overhaul and extending the life of the aircraft (LEP). These costs represent the major ticket items to be incurred in the next 20-years. With an average

annual cost of only $62,901, replacing these units with newer platforms would not be a good financial investment. From a financial perspective, the cost of capital to acquire a new PC-12 aircraft will be way higher than putting money aside to pay for the big maintenance items.

Table 16 - Comparison table: Annual Capital Expenses for the Acquisition of New PC-12 Aircraft versus the Annual Maintenance Costs of Keeping Old PC-12 Aircraft

New PC-12NG Price (In USD)	4,888,275 $
New PC-12NG Price (In CND - @ 1.31 CDN/USD)	6,403,640 $
Annual Capital Requirements* - Purchasing new PC-12 **Annual interest and principal repayment over 25 years @ 4% interest rate*	**409,910 $**
Annual Average Cost for Large Maintenance Items - Keeping old PC-12** **Annual cost value was drawn from the total 20-year maintenance costs for tails C-GMPP, C-FMPB, C-GMPY	62,901 $

In addition, when reviewing the maintenance requirements for the other PC-12 platforms, we have not identified any aircraft requiring such a high load of maintenance that will justify the replacement of the asset with a brand new aircraft. Although, for the highly utilized units, the cost will be higher, reaching almost $2M for C-GMPV. With an average 995 flight hours flown per year, and a time before overhaul of 5,000 hrs, the Iqaluit's platform will require more overhauls over the studied period which explains the higher cost estimate. The same reasoning applies for the Prince George's asset which ranks in third place with $2.6M of forecasted maintenance cost mainly comprised of engines overhauls.

The analysis key takeaway summaries for the other aircraft are performed in the paragraphs below.

EC-120B and Euro B3

The rotary-wings aircraft are among the more costly platforms to maintain. These platforms are heavily utilized and given that engine's TBO is at 3,000 hrs and cost $240,000 USD, overhauls are needed more frequently. The RCMP is considering increasing the TBO to 3,500 hrs.
As indicated during the interview process, an internal risk analysis will be required prior to making the decision to move ahead with the increase. Only one aircraft (C-GMPN) is due for a replacement of its main rotor blade (Year 18) for a cost of 162,000 USD in today's dollars.

DHC6-300

No major scheduled inspections aside from the engine overhaul at 7,500 hrs are part of the DHC6-300 maintenance schedule. As for time limits, wings replacement is due every 66,000 hrs. DCH6-300 has presently 35,600 logged hours and with an average of 533 hours flown every year, it will take 57 years before it reaches the 66,000 hrs replacement milestone. However, due to some recent issues with the aging engines, ASB is now using a 5000 hrs TBO. Consideration should be given to upgrading the engines to -34 model by incorporating a Service Bulletin.

Cessna T206H and 208

Engine overhaul at 7,500 hrs represents the only big ticket items for these two platforms. As the three (3) 208 aircraft are flying on average 373 flight hours/year, the overhaul frequency will be due every 13, 18 and 57 years respectively for the three 208 depending of the aircraft's flight rate. This explains the low maintenance needs over the period not to mention that the 208 aircraft have overall very low maintenance requirements.

Kodiak Quest K100

Kodiak's engine overhaul is due every 4,000 hrs and time since last overhaul is at 550 hrs. This puts the next overhaul in 23.4 years beyond the 20-year timeframe. The review of the maintenance manuals for the K100 aircraft did not reveal any other major maintenance items that should be encompassed in the present study.

14.4 Findings

As opposed to a for-profit corporation, the RCMP is not interested in preserving book values for its shareholders. As any other Crown entities, the RCMP is pressed to reduce its operating costs and demonstrate that it is making the best and highest use of its air assets. As a part of the highest use criteria, the RCMP must ensure that the life cycle management cost of its fleet will remain stable and under control over the years. The present maintenance costs analysis have led to the following observations which when coupled to the demand-use evaluation criteria, will help in determining which air assets should be renewed:

a. The current RCMP fleet mix does not entail large maintenance items that are beyond RCMP's paying capacity;
b. Findings show that for most of the aircraft fleet, the costs to be disbursed by the RCMP in the next 20 years are mostly tied to engine overhaul's frequency;
c. Should the RCMP trade-in old platforms for new ones, for example C-GMPN, the maintenance requirements will remain pretty much the same. Overhaul will still be due at 3,000 and major inspections every 12 years. The only element that will be postponed is the replacement of the main rotor blade which is coming due in 2033 for that aircraft.
d. Life extension program for the PC-12 does not entail an unmanageable price tag ($265,000 USD). Although, the service bulletin requires a minimum of 100 days of shop requiring the air asset to be grounded for the duration of the maintenance work. This could impede the capacity for the RCMP to deliver services in the region these aircraft are stationed. In the next 20 years, eight aircraft will hit the 20,000 hrs limits and will have to undergo such program and therefore a plan needs to be developed to ensure proper stagger.
e. Some can argue that aircraft should be trade-in before these major components hit their time limits (Life Extension Program, Main Rotor Blade Replacement) in order to maximize their resalable value, but in reality, the pre-sale inspection would have indicated this upcoming maintenance item and the price would have been consequently amortized.

14.5 Other considerations

For the most part, the aircraft economic life is dependent on aircraft fatigue caused by the repeated cycles to which the aircraft is subjected. The most damaging of those cycles are the pressurization cycles as the aircraft goes through repeated ground-air-ground (GAG) cycles. Fatigue also affects other components of the aircraft but for the fleet of aircraft used by the RCMP, this is not the most significant factor. On unpressurized aircraft, some critical components such as wing structures and major skins, fittings, ribs, longerons and spars would have a non-destructive inspection to be performed at pre-determined intervals to detect potential cracks that are readily repaired.

On older aircraft, there is the likelihood of older avionics that may face obsolescence issues that can be fixed by replacing the old units by new more modern systems at a cost that would be far less that aircraft replacement. For the aircraft currently in service, the main driver is to ensure the aircraft are well maintained and updated to keep them refreshed as they would deteriorate with time. 20 years is not necessarily a long time in the life of an aircraft. A factor that usually plays in the determination of a commercial operator to keep an aircraft or replace it is the residual value of that aircraft upon selling. This would offset the cost of the replacement aircraft that would be amortized over another fixed period that will depend on the type of operations.

Helicopters have a number of life limited items that are replaced systematically at a pre-determined number of cycles/hours. This would take place on newer as well as older aircraft. For Airbus helicopters, they have a 12 year major inspection and overhaul. The cost of ownership for the first 12 years is relatively low. Following that major overhaul, the helicopter regains most of its value. The tendency is to sell that helicopter half way between the two overhaul cycles, hence at the 18 year mark. Given the engines still have reasonable hours on them, at that time, the helicopter still has good value and can be sold anywhere in the world. After 20 years, it is sometimes better to sell these helicopters internationally.

15 Management of the Operation and Air Service Delivery

15.1 Governance

As an introduction to this section, it is imperative to understand the governance requirements for ASB and the role the Policy Centre needs to play based on its accountability requirements.

Sound governance includes national management structures such as policies, processes, standard practices and training facilities. It is difficult to be accountable without direct oversight. The Policy Centre has some oversight over some elements of the Air Services Operations but it is limited and hence it has to be questioned whether this fully meets the intent of Transport Canada's requirements for accountability.

There has been a relocation of aircraft based on available information over the past few years. There are no indications that an analysis has been undertaken to determine the demand for air services and this is mainly due to the lack of actual data to perform such an analysis. The concept of scheduling based on need was identified in the 2012 Annual Report by the Office of the Auditor

General of Ontario on the OPP. The report highlighted "... a key to operating cost-effectively is having the right number of officers working at the right times" For air services this would mean using their flight data to identify trends in flight requests by week, month and year to ensure that they have the optimal number of pilots available for peak flight times. This should be commonly done over the entire ASB units.

The RCMP Fatigue Management System (FMS) provides a number of restrictions for each pilot to manage their flights to ensure proper rest is available for pilots. In locations where the number of pilots is limited, it might be possible to have a national relief pool of pilots. Currently, the schedules are done in different ways without really considering the demands as demands data is not available.

There are a number of factors that impact aircraft usage. The location of the aircraft, the needs of the division and its geographical location must all be taken into consideration. Data input into PFM is still inaccurate. It has been mentioned that still some pilots do not complete PFM data entry after flights. Sometimes it is done later and the information turns out to be inaccurate.

The challenges in having the right assets in the right place based on a national requirement are imperative. The ability to move aircraft around and providing the type of aircraft that best suits the needs of an operation needs to be coordinated nationally. The ability for the Policy Centre to remain informed and ensure quality and safety management responsibility is the key to a successful operation.

15.2 RCMP Situation

15.2.1 Flight Coordination

Flight Coordination is currently performed at the regional Division Level, normally by one person. At some bases, there is no one to perform the work and the responsibility falls back to the main Air Section Base or it is given to somebody as a secondary duty, with little training and when no support is provided by the main section. Part of their work is to build the flight schedules based on aircraft availability and priorities. They are responsible for collecting the flight request forms (form 3640) and process them as well as ensuring the data is properly entered into the Flight Management Software, PFM (Professional Flight Management) for data gathering.

The decision for a given flight to be authorized is strictly based on local priorities and does not take into consideration potential higher priorities in the broader region.

Although the use of form 3640 is compulsory for each of the requests and potential requests, some units respond to phone-in and email flight requests. This implies that not all requests are recorded and some flights rejected without knowing and without recording the reason for declining the service. This is a serious problem of accountability and standardization of processes.

15.2.2 Maintenance

For the most part, both scheduled and unscheduled inspections are performed by the unit's AME(s). Occasionally additional support will be provided by additional ASB resources or through outsourcing of the scheduled inspection.

The decision to remove an aircraft from service for inspection is normally taken between the AME and the Officer-in-Charge (OIC) of the base based on perceived needs, available personnel and the hours left on the aircraft. There is very little consideration given to ensuring a regional stagger for inspection which may lead to having more than one asset down for inspection at any one time depriving the region from assets that can provide mutual support across divisions. This is a serious problem.

There are no clear performance requirements to complete the inspection (preventive inspection) in a given pre-determined objective (timeframe). Understanding there are snags that will require corrective maintenance and parts that may cause delays, this situation does not lead to having a clear focus to meet stated measured objectives. The consequence to this is that aircraft inspections will not necessarily systematically be completed in the most efficient manner and the performance of the inspections is very much left to the individuals.

15.2.3 Delivery of the Service

The RCMP operates for the most part as a contractor to eight (8) provinces and three (3) territories. Among that work, there is also federal tasks in those provinces and in the provinces of Quebec and Ontario where they have no contractual arrangements as in the other parts of the country.

Demands are requested through the Divisions and executed by the Air Section. There is a very close working relationship between the Division's CROP or Line officers and the Base ICs.

15.3 Benchmark of four (4) similar organizations

15.3.1 Compilation of the Benchmarking Survey

For the purpose of understanding industries' best practices the consultant performed a benchmarking exercise surveying six (6) organizations that either had similar operations or similar fleets.

Following is a summary of the information gained in telephone interviews with other operators of aircraft types similar to the RCMP.

Table 17 - Benchmarking Results

Subject	Operator's Name						
	Chrono Aviation	Edmonton Police	Hydro One	Morningstar Express	North Star Air	Ont. Ministry of Natural Resources	RCMP
Aircraft Operated	(6) PC-12	(2) EC120B	(7) AS350	(7) Cessna 208B Caravan	(5) PC-12	(1) AS350, (7) EC130's	(16) PC-12, (7) AS350, (2) EC120, (3) C208
Operations	Charter airline	Airborne Law Enforcement	Corporate – emergency services, patrol, crew placement	Contractor to Federal Express	Charter and scheduled airline	Government agency – fish & wildlife, forest fire control.	Airborne Law Enforcement
Hours Flown	1,000 hrs / year / aircraft	1,000 hrs / year / aircraft	600 hrs / year / aircraft	1,400 hrs / year / aircraft	1,700 hrs / year / aircraft	500 hrs / year / aircraft	PC12 – 818 hrs / year C208B – 407 hrs / year AS350 – 359 hrs / year EC120 – 556 hrs / year
Maintenance Performed By:	Levaero	(1) Contract AME	Own AMEs	(1) AME / aircraft plus contract AMEs	Levaero	Own AMEs	Own AME's
# of technicians per major inspection	150 hr – 4 Annual - 6	1	2	100 hr - 6	150 hr – 4 Annual - 6	100 hr – 1 to 4	?
Time down for major inspection	150 hr – 14 hrs Annual – 7 days	100 hr – 3 days	100 hr – 2 days	100 hr – 2 days	150 hr – 14 hrs Annual – 7 days	?	?
Dispatch Reliability	?	100%	?	99.7%	?	?	?
Labour Hrs per Flight Hr	1.0 : 1.0	?	?	1.4 : 1.0	1 : 1	?	?
Routine to Non-Routine Labour	1.0 : 2.5	?	?	1.0 : 0.272	1.0 : 2.5	?	?

15.3.2 Benchmarking Observations and Conclusions

Commercial operators in the above examples appear to be more interested in monitoring their maintenance then the private operators. All of the operators in this sample knew what their down time was for a major inspection and all stressed the importance of keeping that to a minimum in order to ensure maximum aircraft availability. Some of these operators use contract maintenance to keep their downtime to a minimum either by sending aircraft to the contractor facility of by having in-service support when required through pre-established contracts.

15.4 Transport Canada Operations

During the interviews, Transport Canada (TC) was contacted to provide the details of their operations. The interview was conducted with Mr. Gerald Toupin the Director General Air Service Delivery (ASD). The idea behind this interview was to understand their business model and assess if there could be synergies with RCMP operations.

TC operates 10 King Air C90's, 8 Cessna Citation 550's and 4 helicopters. In addition, TC provides the flight crew for the Canadian Coast Guard fleet of aircraft which consists of 1 Dash 7 surveillance aircraft based in Ottawa, 2 Dash 8 surveillance aircraft based in Vancouver and Moncton, 15 Bell 429's which just recently replaced the MBB105 helicopters, 5 Bell 212's soon to be replaced with new Bell 412EPI helicopters. In addition to providing and managing all the flight crew for the Coast Guard, TC does all the maintenance on these aircraft.

TC also does all the maintenance on the DND Challenger aircraft which consist of two 604's and two 601's. The Challengers are used to fly the Prime Minister, the Governor General, some Ministers and the Royal Family as well as handling some emergency response requirements. In addition TC has recently accepted a maintenance contract for the maintenance of some of DND's Griffon (Bell 412) helicopters. This maintenance includes performing 300 hour / 600 hour inspections. TC also does some maintenance on DND's Dash 8 training aircraft in Winnipeg.

TC Air Services is an AMO, DAO, TC approved training facility and approved by DND to carry out maintenance on military aircraft such as the Challengers and Griffons.

There are 311 personnel in TC Air Services which includes 70 pilots and 140 AME's. TC also has their own structural design engineers and can design their own mods and repair schemes and have them approved under their TC DAO.

All the maintenance work TC does for DND and the Coast Guard is on a cost recovery basis.

Information Systems

Their maintenance, material management, and flight management software is even more antiquated then what the RCMP is using. This is one area where TC ASD really needs improvement. His inventory management software does not interface with his maintenance software.
They use CAMP for maintenance, AMOS for material management and Flight Pack for flight dispatch. One system will not talk to any of the others. An integrated solution is needed and is being investigated.

Centralized internal solutions were developed to provide the management information required to run the organization. They have developed a significant amount of performance metrics that allows them to meet the operational requirements of their "clients", internal and external. Some of the information tracked is: maintenance labour hours, which are further broken down between routine and non-routine labour per aircraft; and maintenance labour hours by flight hour per aircraft except for the Coast Guard bases.

They do not track dispatch reliability of their aircraft but they do track aircraft availability based on their client's needs. For example, based on 4 DND Challengers, they must have 2 available on a 24/7 365 day basis 100% of the time. They must have 3 DND Challengers available on a 24/7 365 day basis 90% of the time. The 4th aircraft is considered a maintenance aircraft and it must be available 65% of the time.

Aircraft Maintenance

The AMEs are centralized in a limited number of bases, allowing them to perform timely cost effective maintenance activities. Their clients require very strict aircraft delivery timelines that require a high level of efficiency.

TC ASD facility on the Ottawa airport is self-contained, vertically integrated and possesses similar capabilities as do many of the largest MRO facilities in Canada. Some of their specialized workshops include a very large avionics shop, wheel and brake shop, hydraulic shop for overhauling helicopter gearboxes and transmissions, NDT shop that can do all types of NDT except for XRay, a lead-acid and ni-cad battery shop, an upholstery shop, a very well equipped metal shop for both sheet metal and machining, a composite repair shop, a paint booth that can accommodate most light helicopters, an electrical shop that is capable of overhauling starter generators, and a wire harness shop with laser wire marker to produce their own wire harnesses.

16 Proposed Models for RCMP's Air Services Operation

16.1 Management and planning of operations

The management and planning of Air Services Operations is currently very de-centralized and offers a number of issues in terms of standardization and compliance. Additionally, the scarce resources scattered in over 17 locations exacerbate these issues. Three (3) options were considered for analysis. The results of that analysis are presented in this section, but the development of the "Pros" and "Cons" is presented in Annex J.

The analysis was performed assuming three (3) potential options:

a. Status Quo;
b. Regional Operational Centres; and
c. National Operational Centre

The proposed solution is to institute a National Operational Centre that would become a Centre of Excellence with the proper staffing and the ability to quickly respond to the demands in a systematic fashion. The following is the summary of the analysis leading to this recommendation.

16.1.1 Background

ASB operates in a de-centralized fashion with a Policy Centre based in Ottawa and local Air Sections located across the country. Depending on their federal or provincial roles, the Air Sections are not necessarily structured or staffed in the same manner. Although the Policy Centre is responsible to Transport Canada for compliance to Canadian Aviation Regulations and to the RCMP Commissioner for Law Enforcement administration, it does not directly control the assets, the taskings or the personnel in mission delivery.

16.1.2 Response to taskings

The local RCMP Divisions directly task the regional/local Air Sections for their respective missions based on a priority system to include surveillance, prisoner transfer/transport, transporting constable to remote areas, transporting ERT teams and other transport or surveillance missions. The detachment manages maintenance and dispatching of the aircraft through local flight coordinators or in some cases through pilots.

16.1.3 Operational readiness and reporting

Generally, the local detachment manages its local issues and reports its activities through PFM (flight operations software program). Through our research and interviews, it seems that the request for taskings, the recording of these requests and the exact outcome are not measured in the same fashion across the country or are not measured at all. The use of PFM does not seem to be standardized at all detachment with some Air Sections not having dedicated on-site flight coordinators or off-site support.

The establishment of readiness goals (measured) followed with structured recording of task requests and all the metrics that should follow are addressed as a separate subject. However this issue is at the heart of the justification for a centralized Operations Centre.

16.1.4 Aviation industry examples

Centralized Operation Centres are prevalent in many sectors of Aviation. Obviously all airlines operate in this manner but large corporate aviation companies such as Netjets, Flexjet, Execaire and Skyservice all have centralized flight coordination/dispatching services supporting hundreds of aircraft all over the world. The same applies to Air Ambulance and EMS services.

16.1.5 Industry's Best Practices

A centralized Operations Centre is operated 24hours a day/7 day a week by dedicated professional flight coordinators/dispatchers who are tooled with the dedicated software system and trained as Master Users. These professional have access to the status of all aircraft in the fleet and to all ASB personnel. As taskings come in, they apply the proper prioritizing decision-making matrix and are supported by a management decision to resolve conflicts.

The Divisions requests would simply be called-in (there is a need for actual registration of all requests in a fashion that would need to be determined) to the one Operations Centre contact number and submit their request. The assignment of the assets either in the form of the next day's planning or the call-out of the standby crew can be as efficient as any local contact as long as the asset and personnel status is well communicated in a standard format. Aircraft airworthiness status can be enhanced by an eventual direct link between the aircraft maintenance software and the flight operational software.

16.1.6 Organizational control

A centralized Operations Centre completely reverses the command and control structure enabling live on-line information to RCMP senior management on ASB status and activities. This proposed structure enables live fleet status, live personnel status, direct tracking of in-coming taskings (data gathering), live measurement of readiness/responsiveness capability and performance. This structure also permits the RCMP Policy Centre to inform Air Sections on their performance rather than getting after the fact partial data from the Air Sections. In case of serious emergencies or national requirements, the central Operations Centre can re-task or attribute other assets as required.

16.1.7 Other benefits

The Operations Centre is a Centre of operational excellence optimizing the information available, the fleet and personnel status. The Centre develops the best practices and optimizes the use and development of the software tool. Fleet or detachment performance reports can be automatically programmed and sent to RCMP management as appropriate.
The recruiting and retention of aviation professionals can also be enhanced through a national Centre based in Ottawa. Appropriate management fees for this service can be inputted to provincial service contracts based on a fixed fee or a per call basis.

16.1.8 Change management issues

The transition to such national operations would require advanced planning and process design. The biggest challenge would be to demonstrate that such an infrastructure would add operational flexibility to current operations by such things as direct call, 24 hour operations, expert flight coordinators, better coordination of all resources and direct data measurement and reporting. Removing red tape, admin functions, database management and reporting would permit local detachment to focus only on direct flight operations and maintenance. Managing the local **perception** loss of operational flexibility would be a communication challenge for the Policy Centre to overcome.

16.2 Air Service Branch Organisation

16.2.1 Background

Although not all Air Section bases are staffed to the same level, there are on one hand duplication of efforts while in some cases, there are bases where personnel are overburdened and additional support should be provided. In an environment where an organization is staffed to ensure all relevant duties are equally performed in each of the units, de-centralization provides a number of benefits.

The drawback of de-centralization is the need for more resources than in an organization that has more centralized functions. This can be very clearly exemplified when corporations make acquisitions and rationalized a number of departments to reduce staff and gain efficiencies. In the case of the RCMP, there has already been a reduction of staff in the last few years but throughout the reduction, there does not appear to have been an assessment of efficiencies that can be gained by rationalizing the work done at and by the many bases.

16.2.2 Rationalization Proposal

Rationalization may require some level of compromise to gain efficiencies and optimize personnel employment. But at the same time, the objective is to do so with minimum impact on operations and a cost reduction on operations that ideally could be converted to personnel or the implementation of high performance asset management tools.

The following rationalization efforts are proposed for the overall benefit of ASB and the RCMP. These proposals are in line in ensuring ASB remains: Relevant; Responsive; Compliant; Competent; Flexible; Responsible; and Accountable. It is believed that it would be a serious risk that ignoring the imperative to restructure ASB units could have a significant impact on the relevancy of the Branch.

"E" Division – British Columbia

Both bases in Vancouver are separated by a half-hour drive. There are AMEs in both locations and they do provide mutual support between the two bases as it makes sense from an organization's perspective to have AMEs that are cross-trained on more than one aircraft. The helicopter base has just recently been moved to Langley. Amalgamating these two bases (Boundary Bay and Langley)

would provide significant benefits to the personnel and to the effectiveness of the operation. AMEs would all be located at the same place and if organized properly, it should have a direct impact on aircraft availability.

"F" Division - Saskatchewan

Both units in "F" Division operate the same type of fixed wing aircraft and from the interviews, it was clear that there is some overlap between the routes performed from Prince Albert and those from Regina. Additionally, the distance between the two (2) cities is relatively small. It is therefore recommended that the facilities in Prince Albert be relocated to Regina. This might marginally increase annual fuel cost but the associated benefits in terms of synergy and concentration of manpower are more than likely significant. There may be a need to rearrange routes allocations as well but the benefits are likely to be very positive on the Division's efficiency.

"D" Division – Manitoba

Both units in "D" Division operate the same type of fixed wing aircraft with overlaps in their routes. This is not quite as clear, since Thompson is further away from Winnipeg than Prince Albert is from Regina. However, ASB should examine a way to re-arrange the routes of each of those two (2) units in consideration for an eventual regionalization in one of the two (2) cities.

Transport Canada (TC) and Canadian Coast Guard (CCG)

As it will be presented in the next section, Transport Canada and Coast Guard bases are, for the most part, co-located. CCG operations and maintenance are managed by TC. Sharing their facilities, in location where it makes sense, with an agreement to share maintenance personnel based on a pre-arranged contract could prove highly beneficial. Additionally, in the instances when an RCMP asset would not be available or none of the RCMP assets would meet the requirement, there would be a potential for ready to use TC/CCG assets based on a pre-defined agreement.

Some potential target locations would be: Prince Rupert, Vancouver, Winnipeg, Ottawa and Moncton.

16.2.3 Rationalization benefits

The benefits associated with the rationalization exercise would have significant benefits in terms of the following:

a. Improved aircraft availability;
b. Reduced maintenance downtime;
c. Improved synergy and better capability to absorb personnel vacancies; and
d. Reduced infrastructures costs.

16.3 Delivery of Maintenance

16.3.1 General parameters

From our study, it seems that one of the weakest elements in delivering highly effective operations lies with the delivery of maintenance. The Air Sections all have a ratio of one or less AME per aircraft without much flexibility to improve their situation. The criteria that have to be considered for this analysis are the following:

a. Flexibility;
b. Minimize aircraft downtime;
c. Increase the ability to absorb vacancies caused by training, leave and sickness;
d. Efficient use of existing resources

16.3.2 Options

The analysis was performed keeping these options in mind. In the final analysis, it was difficult to focus on one single option as they are dependent on a number of other decisions that form part of the recommendations. Therefore those options are elaborated somewhat indirectly in the analysis.

a. Status Quo;
b. Creation of a relief pool;
c. Through consolidation of Air Sections, co-locate more AMEs in one location;
d. Outsource (TCCA and/or industry)
e. In-Service Support

16.3.3 Background

The RCMP Air Services Branch operates in a de-centralized fashion with a Policy Centre based in Ottawa and local Air Sections located across the country. Depending on their federal or provincial roles, the Air Sections are not necessarily structured or staffed in the same manner. Although the Policy Centre is responsible to Transport Canada for compliance to Canadian Aviation Regulations and to the RCMP Commissioner for Law Enforcement administration, it does not directly control the assets, the taskings or the personnel in mission delivery.

16.3.4 Operational Readiness

Local Air Sections are normally staffed with two (2) pilots and one (1) AME per aircraft. Since the Air Section is responsible for all aspects of daily operations, the AME ensures daily inspections and snag/discrepancy repairs are made quickly to ensure dispatch reliability. The regular calendar or planned inspections are managed by the local AME with some support from the Policy Centre. This local control has its issues since it is based on available working hours of the local AME who often has little or no support for his inspections. In addition, vacation, paternity/maternity absence or any unforeseen absence due to sickness/turnover can negatively affect the timely completion of maintenance work.

16.3.5 Centralized Maintenance Control and Planning

The necessity for local Air Sections to be staffed with AMEs is not in question, however a Centralized Maintenance Control and Planning Centre would offer optimal maintenance control over the aircraft based all over the country. Under this structure, the current Director of Maintenance maintains oversight and responsibility for compliance to Transport Canada regulations and other administrative roles in the RCMP reporting structure.

The key role in a centralized structure is the Master Maintenance Planning role. Based on the use and total implementation of a maintenance software system such as WinAir, the Master Maintenance Planning function manages a live on-line status of all aircraft across the fleet. With this high level view of the fleet, it validates on a daily basis all upcoming requirements for the fleet to include Airworthiness Directives, Transport Canada Safety Bulletins and alerts, manufacturer Service Bulletins and their applicability for the specific aircraft and all future regulatory requirements susceptible of affecting the fleet. With this information in hand, Maintenance Control would inform the local AME of applicable information directly affecting his/her specific aircraft.

A complete daily dashboard status of the fleet also could help provide real-time aircraft maintenance status to a National Operations Centre especially if the operational software is linked through an interface. As an example, an interface between PFM (or another system) and Win Air could provide automated real-time updated serviceability status to the Operations Centre dashboard including upcoming forecasts.

16.3.6 Planned Maintenance Inspections

Using the maintenance software data and forecasting scheduling based on planned flights and/or historical aircraft usage data; short and long term maintenance planning can be optimized. As specific inspections approach, the Master Planning Role can issue appropriate task cards, plan the downtime and pre-order standard parts and consumables. If the inspection is too onerous for one mechanic or the aircraft downtime negatively affects aircraft availability/readiness, the Centralized Maintenance Centre can reassign additional RCMP AMEs from other Air Sections, find local contractual support to conduct the inspection in an efficient manner or move the aircraft to another Air Section where adequate maintenance personnel are available. The appropriate downtime should be driven by operational readiness goals developed with local or provincial users/customers. There is a need to augment existing resources to ensure the effective completion of scheduled maintenance.

16.3.7 Data Gathering and Statistical Reporting

Based on the Master Planning concept, fleet maintenance data can be gathered and measured in real-time. The ability to track man-hours per maintenance task and overall costs will be significantly enhanced since the data is controlled by the Master Planning role.

16.3.8 Outsourcing of services

The National Maintenance Centre can better source specialized services that are not done or covered by the RCMP and put in place service agreements in order to provide better

responsiveness for local Air Sections. The National Maintenance Centre can also provide Quality Assurance to be vetting these specialized AMOs, a task that local AMEs cannot adequately fulfil. The same applies for sourcing parts, negotiating pricing and managing logistics/shipping/customs; a centralized procurement approach and control ensures parts meet all regulatory requirements which cannot be done locally.

16.3.9 Potential Synergies with Transport Canada

Transport Canada (TC) operates a fully certified AMO managing the maintenance programs for twenty (20) Canadian Coast Guard helicopters at nine (9) different sites around Canada with several co-located or near RCMP Air Sections. In addition, they maintain twenty two (22) aircraft at seven (7) different bases for TC, DND and Ottawa Police. They also support other DND maintenance work for Griffon helicopter 300 hour and 600 hour checks. The Transport Canada maintenance AMO has developed a Centre of excellence including certified shops such as avionics, sheet metal, wheel and brake, hydraulic shop for overhauling helicopter gearboxes and transmissions, a lead acid and ni-cad battery shop, an upholstery shop, an electrical shop capable of overhauling starter generators, a wire harness fabricating shop and Non-destructive Testing (NDT).

Transport Canada has maintenance capabilities in the following sites:
Prince Rupert BC, Victoria BC, Parry Sound BC, Quebec City Que, Shearwater NS, Saint John NB, Charlottetown PEI, St-John's Nfld, Stephenville Nfld, Vancouver BC, Winnipeg MB, Hamilton Ont, Dorval Que, Moncton NB, Ottawa Ont.

17 Performance Metrics for Air Services Operation

17.1 RCMP Evaluation Criteria and Metrics

The RCMP currently tracks very few metrics and that is mainly due to the limitations of the tools it has at its disposal. They have been tracking basic aircraft information such as flight hours, hours per mission type, number of days the aircraft is not available but without the cause.

During a presentation made in the fall of 2015, ASB had indicated the need for further information tracking and identified parameters to measure. During that period, ASB procured WinAir, a commercially available Maintenance Software that has the ability to address the metrics intended by ASB.

The following are metrics identified by ASB:

- Total # of hours flown nationally including fixed, helicopter and surveillance (Flight Time) **(break down of hours per aircraft)**
- Total # of nautical miles flown **(break down of miles per aircraft)**
- Total # of hours devoted to Federal/Provincial/Municipal operations (Flight Time)
- Total # of hours devoted to RCMP Business **(Administrative travel is not related to a specific operational file or investigation. Hours recorded also include aircraft maintenance and RCMP Training)**

- Total # of hours dedicated to transporting pax, prisoners, exhibits, surveillance, IBET, SAR, Missing persons, ERT etc.
- # of hours aircraft down due to maintenance
- % Aircraft availability **(Calculation: Total time - Flight time = Total available time)**
- % of requests denied due to maintenance/unavailability
- % of requests by Priority Level **(Effective date: October 1, 2015)**
- Avg hours flown for fixed wing and rotary (by Region?) **(GOAL here is to demonstrate the need for a specific aircraft per air base) fixed vs rotary vs (Jet).**

17.2 Industry standards and Recommended Key Performance Indicators (KPI)

For the RCMP, metrics can be obtained from two different sources; PFM and WinAir (as it is being deployed, it is assumed this is the standard for the RCMP. The first one providing operation information and the second more linked to maintenance availability and cost.

17.2.1 Operational KPI

Availability / Readiness Metrics

It is important for management and decision making purposes that each RCMP air base be measured in its performance to determine if the base has adequate resources to carry out its Airborne Law Enforcement mandate, which include the number of aircraft, type of aircraft, number of maintenance personnel and number of flight personnel.

Each and every request from ASB's clients should be tracked and coded as to the nature of the request and if the request could not be filled in the clients required time frame, the reason for this failure.

Suggested reasons for coding each inability to fulfill the request are:

1) asset already reserved for other tasking,
2) asset away from base,
3) not available due to maintenance; *(dispatch reliability)*
    a) Scheduled maintenance,
    b) Unscheduled maintenance - AOG,
    c) surveillance equipment not functional,
4) not available due to lack of flight crew, *(dispatch reliability)*
5) mission parameters cannot be met,
    a) Range,
    b) Payload,
    c) Crew duty,
6) cancelled due to weather / unforseen circumstances (status of airport, etc...)

The data captured from this form of tracking and coding will provide management with insight into the ongoing effectiveness of the air base and highlight areas for improvement. Data involving availability / readiness can then be presented on a weekly, monthly and annual basis and could include such elements as:

1) total days downtime for scheduled maintenance, *(dispatch reliability)*
2) total days downtime for unscheduled maintenance / AOG, *(dispatch reliability)*
3) total days downtime other: lack of crew, etc... *(dispatch reliability)*
3) total flying days,
4) total days away (including days away not flying),
5) total days available - readiness,
6) total flying hours and subset;
    - average stage length
    - average flight hours per day in use;
    - ratio of flight hours to cycles;

Based on interviews conducted, it appears that some bases have taken it upon themselves to track the calls they get for an aircraft and the result of those calls. One bases uses an excel spreadsheet and another logs the request in the Professional Flight Management (PFM) software.

For any form of tracking system to be effective, it must be employed 100% of the time. This not only pertains to the discipline of Air Services personnel to use the system, but Air Services customers must also be coached in to calling Air Service each and every time they have an aircraft requirement – even if they know the particular aircraft they need at that base is not available.

It is our recommendation that Air Services use PFM to track all calls from their customers.

Dispatch Reliability Metrics

Dispatch Reliability can be defined as the readiness of an available aircraft when required for a flight. This can be measured as a percentage in terms of the number of calls for the use of an aircraft in the fleet versus the number of times the aircraft could be dispatched.

The purpose of measuring dispatch reliability is to provide an accurate assessment of the effectiveness of aircraft operations to have an available aircraft launched within a predetermined period of time when a requirement for the aircraft exists.

For example, contracted operators for Federal Express must document each flight in terms of its dispatch reliability and the minimum requirements are specified in the contractor's agreement with Federal Express. Not meeting the minimum can have negative financial implications for the contractor, and if it persists, give cause to lose their contract. For example one Canadian operator of seven (7) Cessna 208B Caravans fly's an average of 1,400 hours per year per aircraft. FedEx calls for a dispatch reliability of 99.2% in this particular operation.

The operator is running at 99.7% dispatch reliability. The Fed-Ex contract states that a flight that misses its scheduled departure time by more than two (2) minutes is considered a delay and counts against their on-time score.

This level of dispatch reliability might be excessive for Air Services type of operations, but the concept is still the same. The point here is that a goal is set and performance is measured to that goal.

Factors in aircraft operations that can delay an on-time departure are maintenance related issues where the aircraft is not available due to maintenance or a flight crew related issue where there are no pilots available for the flight or the pilots who are available have reached their maximum duty time and unable to fly. Issues beyond the control of the operator that would not affect dispatch reliability, in the RCMP's case would be the inability to dispatch an aircraft due to weather related issues.

Measuring and documenting dispatch reliability will allow RCMP Air Service management to better understand the issues that are preventing them from meeting their Airborne Law Enforcement mandate.

Maintenance Labour Metrics

Each type of aircraft has a set number of scheduled maintenance / inspection tasks (hourly and calendar) that must be performed throughout the course of the aircrafts life and the time spent by maintenance personnel in performing these tasks can be measured in hours. This is referred to as ROUTINE maintenance. In addition, each aircraft will have additional maintenance that arises in the course of performing ROUTINE maintenance or as a result of failures, which occur during normal flight operations. This is referred to as NON-ROUTINE maintenance.

Typically, over the years as an aircraft ages (in terms of calendar time and flight hours), the ratio of Non-Routine labour to Routine labor grows. For example, a new aircraft may have a ratio of 0.5 hours of Non-Routine labour to every hour of Routine labour. By the time the aircraft has reached 5 years of age or 5,000 hours, that ratio may have changed to 1.0 hours of Non-Routine labour to every hour of Routine labour. As the aircraft continues to age the number of Non-Routine labour hours grows.

Tracking this ratio of maintenance labour is of particular value to an operator who has more than one aircraft of a given type in their fleet as it allows the operator to compare each aircraft to the others in the fleet. The value in tracking this is to determine which aircraft in a fleet are the most maintenance labour intensive and determining which aircraft in a fleet should be replaced first. Tracking this on a single aircraft type in a fleet can also be valuable, but due to the lack of other aircraft in the fleet as a comparison, the operator would need data from the manufacturer or similar operators to make a comparison.

Tracking the cost of parts and unscheduled repairs of components is also valuable, but it is not as good an indicator of the declining condition of an aging aircraft as maintenance labour can be.

It is recommended that the RCMP set up a coding system in the newly acquired WinAir software and collect and code all hands-on maintenance labour hours that go in to each and every aircraft in the fleet. The labour should be categorized as ROUTINE or NON-ROUTINE. Examples of maintenance tasks in each category are:

ROUTINE

All scheduled maintenance and inspection labour such as:

- Daily
- 100 / 150 / 200 / 300 / 500 hour inspections etc.
- Annual inspections
- Special Structural Inspections
- Inspections after a prop / blade strike or hard landing
- Service Bulletins
- Airworthiness Directive Compliance
- Damage repairs

NON-ROUTINE

All unscheduled / unplanned maintenance labour that arises from periodic inspections and failures / discrepancies that occur during the course of normal aircraft operations that require investigation and rectification.

It is recommended that the RCMP Air Services implements this method of coding in WinAir and conduct in depth education and training to all maintenance personnel to ensure all maintenance labour performed is properly coded.

18 Conclusion and Recommendations

This section provides the conclusion of the study in terms of findings as well as a series of recommendations that have resulted from the consultant's observations and as mandated by the contract. The following sections provide a series of findings and associated recommendations for each of the objectives of the mandate.

18.1 General

18.1.1 Findings

Finding #1

In the documentation reviewed and the interviews performed, there was no mention of actual operational requirements in the decisions made. The first and most important finding is that the RCMP has no operational requirements statement or performance statements for its Airborne Law Enforcement Branch. Any analysis being performed is based on what is being accepted and not what is being expected based on the operational needs of the force. The closest element in place to this, is the priority matrix developed within ASB, but not so much as a way to answer operational demands but as a common sense approach to optimize the scarce assets. Without such statements, the work is performed to meet what is the expected demand, which varies across the country without a measure on how well ASB is delivering the service as there is no standard against which to measure performance.

Finding #2

ASB Policy Centre is responsible and accountable for the airworthiness of its fleet and for delivering air services in a safe and effective manner. However, it appears its influence on the management of assets is limited. This situation is problematic and the role of the Policy Centre needs to be re-thought.

18.1.2 Recommendations

Recommendation #1

RCMP executives need to determine the role and level of performance from ASB based on data that takes into consideration their actual operational requirements. This has to be measured and ASB has to be provided the resources to meet the stated objectives in order to be accountable to the established level of performance.

Recommendation #2

ASB Policy Centre should be rebranded to better reflect the role it actually plays in the delivery of air support to the policing role of the RCMP. Furthermore, it needs to have broader powers to control the various elements that are required for air service delivery, flight coordination, maintenance, allocation of personnel and allocation of assets. A title along the lines of "Airborne Law Enforcement HQ" would be a good start for discussion.

Recommendation #3

There is a sense from some of the personnel encountered that ASB should select its aircraft based on the requirements that personnel Furniture and Effects (F&E) be moved internally without relying on external contracts. First, doing that would skew the size of aircraft requirements and secondly it would take away scarce operational assets. Also, the RCMP, as most government organisations, has a contract in place for personnel transfers. This would be competing against private industry and against regulations. Additionally, moving furniture and effects for members incurs a certain level of liability that would be unwise for the RCMP to assume.

18.2 Needs assessment and demands analysis

The preliminary work of research, document review and interviews was to be the basis of the analysis that has led to the conclusions and recommendations in this report.

18.2.1 Findings

Finding #3

The expectations for ASB are based on the direction provided at the Divisions' level. There are no clear statements and Air Section ICs and staff are subjected to the perceived pressures of Divisions' Line Officers. Each demand, no matter how infrequent, is perceived as an actual must have and is described as a requirement. While at the same time, limited resources from the Policy Centre don't seem to address the "needs" This is a source of frustration and inconsistent perception across the country. This should not be reinstituted.

18.2.2 Recommendations

Recommendation #4

To prevent frustrations on the part of ASB personnel caused by the perceived requirements that cannot be met due to policy and budgetary constraints, there is a need to develop and publish clear performance objectives for each of the Sections in order to manage expectations on all sides.

18.3 Determination of optimal platforms

18.3.1 Findings

Finding #4

There are no actual Performance Objectives or Statements of Requirements available to assess how well existing aircraft or any other aircraft satisfy the requirements. This is the basis of any analysis and nothing is available to make a proper assessment.

Finding #5

Based on the interviews and on the information available, it is believed that the following aircraft currently in service perform the required tasks to a level that is at least 80% - 85% and for which there are no issues. Assets that would meet 100% of the requirements would be cost prohibitive and would be ill-used 5% of the time:

a. Larger Transport Aircraft/High Altitude Surveillance – For these roles, the PC12 is a good aircraft capable of delivering the vast majority of the missions being demanded with the added benefit of a high level of commonality in the fleet.
b. Smaller Transport Aircraft/Lower Altitude Surveillance – For the surveillance role, the C208 is a good aircraft that meets most missions' demands. For the transport role, the Kodiak, although with limited usage, and the C208 meet their transport role well for the majority of the demands.
c. Special Case Transport Aircraft – This is the Twin Otter. This aircraft has performed venerably for many decades and continues to serve well. It is however, an aging aircraft that may soon need to be examined.
d. Patrol Helicopter – The EC120B is a good fit for its role of supporting surveillance and patrol requirements over cities. It is being used by many law enforcement organizations around the world. It is safe, agile, reliable and economical to operate.
e. Transport/Surveillance Helicopter – The AS350B3 is a widely used helicopter for aerial work around the world. It is well suited to perform the majority of tasks within the RCMP requirements.

Finding #6

All aircraft are powered by piston engines except one which is turbine powered. The piston engine aircraft are noisier and considered to be less reliable. Additionally, there are serious concerns with respect to the ergonomics of the TFO position and his/her safety. This has to be looked at very carefully.

18.3.2 Recommendations

Recommendation #5

A complete evaluation of the C206 has to be performed in terms of its ability to perform the mission it has been assigned and the cost of performing the required modifications to render the aircraft safe to operate. Once that assessment has been completed, a business case needs to be developed to compare modifying the aircraft with that of replacing it by an alternate platform such as the Kodiak or C208 which would provide good fleet commonality, or with the Diamond DA62.

Recommendation #6

There are concerns about the remaining useful life of the C208 in Prince Rupert. The situation has to be assessed by qualified personnel before a decision is made on the future of the aircraft. As such the following steps are recommended: an engineering assessment needs to be performed to determine the extent of the corrosion concerns through a systematic mapping process. From that assessment, there would be a determination for the options to move forward. Among those options, one would be to implement a specific corrosion control program that would maintain the aircraft airworthy, another one to perform an extensive overhaul that would allow the aircraft to remain in service for a long enough period of time or the recommendation could be to replace it at a pre-determined time. The concerns are both related to airworthiness and economics but the decision has to be based on an engineering evaluation performed by a qualified engineer, ideally with DAR qualification, who would evaluate the damages against the OEM tolerances. The OEM could ultimately be involved in making the determination.

Recommendation #7
Twin engine helicopters should be procured as a way to meet increased payload and endurance requirements that would be justified through the use of captured data demonstrating there is frequent enough demands to warrant the additional expenses.

Recommendation #8
Based on the information available, there has been little demonstration for the actual need of larger more powerful aircraft. However, it is understood that the occasion arises when this is the case. For those occasions, ASB has to have a global strategy that takes into consideration all possible options and that means are in place to activate those strategies as required. It is recommended that the RCMP establishes a number of Standing Contracts that can be quickly executed with commercial operators or other organizations (including Transport Canada) across the country as a way to fill the gaps.

18.4 Determination of optimal replacement schedules for each aircraft type

18.4.1 Findings

Finding #7
The analysis of the maintenance requirements for the next 20-years does not suggest that the RCMP should replace some of its air assets with the aim to avoid disbursing large capital amounts to pay for big maintenance items. The cost of ownership, or life cycle cost of the aircraft, is tied mostly to scheduled maintenance items such as engine overhaul, these maintenance costs are based on the utilization of the aircraft. As such, whether or not the aircraft is new or old these costs will have to be incurred by the RCMP.

Finding #8
The major checks and units replacements that need to be performed over the life of the aircraft are manageable from a cost perspective for an organization the size of the RCMP. For example, no scheduled maintenance items are above the $500,000 mark and consolidating these costs over 20 years, the total for most aircraft does not exceed $2M in maintenance spending.

Finding #9
Aircraft tend to be generally reliable and daily maintenance checks do not vary greatly with the age of the aircraft and remain pretty stable over the asset's life. However, as aircraft are aging, occurrence and importance of unscheduled maintenance events (labor and parts) is likely to increase. Incorporating unscheduled maintenance items in our analysis would have potentially led to the identification of some problematic aircraft for which a replacement solution could have been envisioned. Such data was not available when the present study was conducted.

18.4.2 Recommendations

Recommendation #9
To be able to perform a more accurate study, it is recommended that the RCMP institutes a rigorous method for measuring the time and cost associated with unscheduled maintenance as this would indicate the impact of aging aircraft on the life cycle cost of the aircraft.

Recommendation #10
Once a determination has been made, using the cost of unscheduled maintenance in the equation, of the best time to replace aircraft, each aircraft should be managed to offer an appropriate stagger to prevent too many aircraft becoming due at the same time.

Recommendation #11
Although there is no hard data within the ASB database, there are commercial practices that suggest that the best time to replace Airbus helicopters (EC120B and AS350B3) is at the 18 year mark. It is recommended that this practice be adopted by the RCMP.

18.5 The most effective and efficient structure for delivery of air operations

18.5.1 Findings

Finding #10
There has been many expanded efforts to implement national standards for the delivery of air services across the country. However, there are still some concerns that the policies are not fully endorsed and adopted across the board.

Finding #11
The Policy Centre is expected to be an enabler that provides the tools, policies, guidance and oversight to support the operational clients. However, given the current organizational reporting lines, and the lack of specific management tools, this is very difficult. In all cases, the client has to be on top of the pyramid and the organization be structured to provide the best possible service in-line with the Raison-d'être of the RCMP. This is not possible in the current organizational structure. Additionally, at the same time, ASB has to be accountable to Transport Canada for the management of air assets and to the Canadian Public.

Finding #12
Although there have been many issues raised by Air Section members about the inadequacy of some of the aircraft, it seems the biggest challenge remains personnel. The number of times aircraft cannot deliver the requested demand is relatively small and economically acceptable. In those rare cases that internal capabilities are not available or suitable, alternate solutions may be put in place. Providing ASB with bigger, faster aircraft would not solve the most important issues that are relating to personnel allocation, distribution and employment.

Finding #13
Flight coordination is performed locally and in a different way from unit to unit. Actual requests are not all captured and the missions declined are not recorded. The flight requests are to be done using the form developed for that purpose, but it is inconsistently used.

Finding #14
There are some issues with the standardization of SOPs, processes and checklists for aircraft operations.

Finding #15
The Director General for ASB changes every two (2) to three (3) years and that person is not generally an aviation person. This is a risk for the organization since the executive manager of the Safety Management System is the Director General.

18.5.2 Recommendations

Recommendation #12
Amalgamate flight coordination activities into one central location in Ottawa that would respond to flight demands 24/7. This would provide standardization of the process, take away the burden from local units and allow for an effective way to measure sortie rate effectiveness.

Recommendation #13
Amalgamate Air Sections that have a similar role and that are relatively close to each other to save resources, increase efficiencies and deliver a higher rate of dispatch reliability. This would bring together more personnel that would be in a better position to absorb most kinds of personnel shortages.

Recommendation #14
Develop a maintenance delivery strategy that takes into consideration every possible element. Where there are sufficient numbers of AMEs, there may be no need to augment maintenance organizations. However, scheduled maintenance downtime needs to be kept at a minimum and having a plan that integrates contracted workers, with the right arrangements, TC ASD assets would greatly enhance the delivery of maintenance. The amalgamation of units would positively contribute to this element. Furthermore, arrangements and co-location with TC ASD bases would further improve the situation. This strategy has to come under stronger control from the Policy Centre who is responsible for the quality through audits.

Recommendation #15
Develop performance targets for the completion of every aircraft scheduled maintenance that will be used for measuring the performance of maintenance and assess any corrective action that may be required to improve the situation.

Recommendation #16
The appellation "Policy Centre" is a weak indication of the role the organization plays and should play in the delivery of air services. The name should be changed to better reflect the role of the organization as a whole and its accountability and need for a higher level of control.

Recommendation #17
Since the Executive Manager rotates every two (2) to three (3) years, the position of Operations Manager, the Accountable Manager, needs to be a position where stability is provided hence reducing the risk. Additionally, if there is a need for the Operations Manager to rotate, the Executive Manager and Accountable Manager should not be rotated at the same time. This would be a risk mitigation scenario.

Recommendation #18

These are important positions and each unit is currently left to itself to implement the program.

Recommendation #19
There is a requirement to develop standardized specifications and rapidly replace There is an urgent need for standardization, an ever greening plan and funding

18.6 Performance metrics

18.6.1 Findings

Finding #16
The RCMP is very concerned about public perception and that has restricted their efforts in getting aircraft that would have provided better Airborne Law Enforcement capability. Their decision has to be based strictly on the needs of the force. The difficulty at this time is that without hard evidence, they are not in a position to explain any of their choices which, makes them vulnerable to defend their decisions. This is the same situation when they need to justify their requests with the government. ASB has very few performance metrics that are used to help them understand their situation and provide them with information to make internal decisions as well as document their demands.

18.6.2 Recommendations

Recommendation #20

This report provides a list of very useful performance metrics that need to be implemented to provide ASB the tools and information required to make the best possible decisions in a transparent and rational manner.

19 References

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K. Government of Canada (TP 15285), Canada Action Plan for the reduction of Gas Emissions from Aviation, 2013 annual report published in 2014.

Annex A - Fleet Composition and Location

Common Name	Model Name	Manufacturing Date	Base of operation (City)	Base of operation (Province)
Eurocopter	AS350 B3	2007	Comox	BC
Eurocopter	AS350 B3	2006	Edmonton	AB
Cessna	T206H	2009	Edmonton	AB
Pilatus	PC-12/47E	2008	Edmonton	AB
Pilatus	PC-12/45	2000	Edmonton	AB
DE Havilland	DHC-6 SERIES 300	1977	Goose Bay	NL
Pilatus	PC-12/47E	2010	Iqaluit	NU
Eurocopter	AS350 B3	1998	Kamloops	BC
Eurocopter	AS350 B3	2005	Kelowna	BC
Cessna	T206H	2004	London	ON
Pilatus	PC-12/47E	1999	London	ON
Eurocopter	AS350 B3	2003	Moncton	NB
Pilatus	PC-12/47E	2007	Moncton	NB
Eurocopter	AS350 B3	2002	Montreal	QC
Cessna	208B	1994	Montreal	QC
Cessna	208B	1994	Montreal	QC
Pilatus	PC-12/47E	2009	Ottawa	ON
Pilatus	PC-12/47E	2010	Ottawa	ON
Pilatus	PC-12/47E	2011	Prince Albert	BC
Pilatus	PC-12/47	2007	Prince George	BC
QUEST	KODIAK 100	2011	Prince George	BC
Cessna	208	2001	Prince Rupert	BC
Cessna	T206H	2004	Regina	SK
Pilatus	PC-12/47E	2014	Regina	SK
Pilatus	PC-12/47E	2008	Thompson	MB
Cessna	U206G	1993	Vancouver	BC
Cessna	T206H	2005	Vancouver	BC
Eurocopter	EC120B	2008	Vancouver	BC
Eurocopter	EC120B	2003	Vancouver	BC
Pilatus	PC-12/47E	2010	Vancouver	BC
Pilatus	PC-12/45	1999	Whitehorse	YT
Pilatus	PC-12/45	2001	Winnipeg	MB
Pilatus	PC-12/47E	2011	Winnipeg	MB

Common Name	Model Name	Manufacturing Date	Base of operation (City)	Base of operation (Province)
Pilatus	PC-12/47E	2008	Yellowknife	NWT

Annex B – Documentations provided for review

The RCMP provided a number of documents that were used to understand some of the elements that have led the Air Services Branch (ASB) to engage in this study. Additionally, some of the documents were used to understand the manner in which ASB captures significant data and how that data is used to make management decisions on Air Services assets maintenance and operation.

In addition to official documents that were provided by ASB, some of the units visited provided the consultants with some locally recorded data. In some cases that data could be validated and in other cases it couldn't. That data was used to complete the information gathered during the interviews.

List of official documents provided by ASB		
Doc. Item	**Title**	**Content**
1	Betterments	List of required improvements or significant maintenance and cost for coming years - Investment Plan
2	Air Services Branch Strategic Plan 2016-2020	ASB Strategic Plan Developed in Dec 2015
3	Spreadsheet - Info for consultants - revised_1	List of aircraft with basic information - airframe hours etc.
4	Equipment List	A zip file containing the configuration of each of the fleet aircraft
5	Aircraft Listing April 2015	List of aircraft with recent moves, when purchased and cost of purchase
6	FleetReview_1	Aircraft Type, YFR, Leg Length and Mission Types
7	ASB-DPR Satisfaction Survey etc. (email)	Summary of client satisfaction - Hours flown per year
8	Performance Measurement - Technical Operations	Presentation on required PMs
9	Replacement for Caravan amphibian GGMPR at Prince Rupert	Information regarding the options for retiring the amphibious Caravan in Prince Rupert. This document provided some information and arguments for the replacement of the Caravan. Not official but used to understand the corrosion problems with that aircraft.

List of official documents provided by ASB		
Doc. Item	**Title**	**Content**
10	AME per base	List of AME allocated and manned for each of the Air Services Bases
11	PPSA AB and SK2011	Typical RCMP contracted agreement with a province.
12	Aircraft_Amortization_1	Aircraft and engine amortization model for RCMP assets
13	NHQ RCMP Organizational Chart January 13 2016	Org Chart for RCMP HQ
14	IP 2015 Final Eng_1	RCMP Investment Plan from 2015 to 2020
15	MA- IP3 Appendices_2016-17 IP Update-2015-11-12	Annual Investment Plan Update for 2016 to 2020
16	2015 Federal Aircraft Reduction Plan	Aircraft reduction from service
17	Air Services Priority MatrixNovember262014	Air Services aircraft utilization priority matrix.
18	Rationale Twin Engine Final (BC)	Rational used to justify the procurement of a Twin Engine Helicopter in E-Division. This document was used to substantiate the procurement of a Twin Engine helicopter within the RCMP.
19	RCMP SMS Dashboard 2014-May 2016	Occurrences observed and reported
20	Bases Audit Reports	10 bases audit reports provided
21	Professional Flight Management - RCMP User Manual	Information regarding PFM capabilities.
22	Ergonomic Assessment of RCMP Surveillance Operator Jan 20_2	Assessment of the TFO seat ergonomics on T206H aircraft

Annex C – Aircraft configuration and roles

Base of operation (City)	Common Name	Model Name	Main Roles	# Engines	Engine(s) Type (s)	Single/Dual Pilot Operation	Surveillance Equipment
Edmonton	Eurocopter	AS350 B3	SAR, PATROL, VIP,	1	Turbine	Single	
Edmonton	Cessna	T206H		1	Piston	Single	
Edmonton	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER, VIP	1	Turbine	Single	
Edmonton	Pilatus	PC-12/45	PAX TRANSPORT, PRISONER, VIP	1	Turbine	Single	
Comox	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER, DRUGS	1	Turbine	Single	
Kelowna	QUEST	KODIAK 100	PAX TRANSPORT	1	Turbine	Single	
Kelowna	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER, DRUGS	1	Turbine	Single	
Prince George	Pilatus	PC-12/47	PAX, PRISONER, FLY-IN COMMUNITIES	1	Turbine	Single	
Prince George	Eurocopter	AS350 B3	SAR, PATROL, VIP, DRUGS	1	Turbine	Single	
Prince Rupert	Cessna	208	PAX TRANSPORT	1	Turbine	Single	

Base of operation (City)	Common Name	Model Name	Main Roles	# Engines	Engine(s) Type (s)	Single/Dual Pilot Operation	Surveillance Equipment
Vancouver (Boundary Bay)	Eurocopter	EC120B	PATROL LOWER MAINLAND	1	Turbine	Single	
Vancouver (Boundary Bay)	Eurocopter	EC120B	PATROL LOWER MAINLAND	1	Turbine	Single	
Vancouver (Langley)	Cessna	U206G		1	Turbine	Single	
Vancouver (Langley)	Cessna	T206H		1	Piston	Single	
Vancouver (Langley)	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER	1	Turbine	Single	
Thompson	Pilatus	PC-12/47E	PAX TRANSPORT, NORTHERN	1	Turbine	Single	
Winnipeg	Pilatus	PC-12/45	PAX TRANSPORT, NORTHERN, PRISONER, RELIEF	1	Turbine	Single	
Winnipeg	Pilatus	PC-12/47E	PAX TRANSPORT, NORTHERN, PRISONER, RELIEF	1	Turbine	Single	

Base of operation (City)	Common Name	Model Name	Main Roles	# Engines	Engine(s) Type (s)	Single/Dual Pilot Operation	Surveillance Equipment
Moncton	Eurocopter	AS350 B3	SAR, PATROL, VIP,	1	Turbine	Single	
Moncton	Pilatus	PC-12/47E	PAX TRANSPORT BETWEEN 3 DIVISIONS, PRISONER, VIP,	1	Turbine	Single	
Goose Bay	DE Havilland	DHC-6 SERIES 300	PAX TRANSPORT, FREIGHT, PRISONER, RELIEF,NORTHERN	2	Turbine	Single	
Iqaluit	Pilatus	PC-12/47E	PAX TRANSPORT, RELIEF, PRISONER, REMOTE NORTHER, SUPPLIES, FREIGHT	1	Turbine	Single	
Yellowknife	Pilatus	PC-12/47E	PAX TRANSPORT, PRISONER, RELIEF, NORTHERN	1	Turbine	Single	
London	Cessna	T206H		1	Piston	Single	
London	Pilatus	PC-12/47E	SOME PAX TRANSPORT, PRISONER, VIP	1	Turbine	Single	

Base of operation (City)	Common Name	Model Name	Main Roles	# Engines	Engine(s) Type (s)	Single/Dual Pilot Operation	Surveillance Equipment
Ottawa	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER, INTERNATIONAL POLICING, EXTRADITION, INVESTIGATIONS	1	Turbine	Single	
Ottawa	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER	1	Turbine	Single	
Montreal	Eurocopter	AS350 B3	SAR, PATROL, VIP, BORDER	1	Turbine	Single	
Montreal	Cessna	208B		1	Turbine	Single	
Montreal	Cessna	208B		1	Turbine	Single	
Prince Albert	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER	1	Turbine	Single	
Regina	Cessna	T206H		1	Piston	Single	
Regina	Pilatus	PC-12/47E	PAX TRANSPORT, LONG RANGE, VIP, PRISONER	1	Turbine	Single	

Base of operation (City)	Common Name	Model Name	Main Roles	# Engines	Engine(s) Type (s)	Single/Dual Pilot Operation	Surveillance Equipment
Whitehorse	Pilatus	PC-12/45	PAX TRANSPORT, NORTHERN FLY-IN COMMUNITIES	1	Turbine	Single	

Annex D - Interview Questions

The interview questions were divided in five (5) categories

a. Interview of Air Services Section Personnel;
b. Division Line Officers/Criminal Operations Officers;
c. Interview of ASB Policy Centre Personnel; and
d. Interview of Other RCMP Policy Centre's Personnel.

D.1 Interview questions for Air Services Section's personnel and Division Line Officers

The following questions were the basis of the interviews conducted during the visits of the various Air Sections across the country. The question set is the same for Air Sections and CROPs officers.

a. Describe local activities and operational situation
b. How are flights being prioritized?
c. Are there any other ways to deliver the services being rendered?
d. Describe the local supply chain in place to support local operations
e. Indicate if the existing fleet is adequate for the missions assigned to this post?
f. How are operations organized and coordinated?
g. How is maintenance performed?
h. What are your thoughts about centralized vs decentralized maintenance?
i. What could be implemented to enhance operations?
j. Are SOPs local or national? What are they?
k. Are aircraft often deployed and when so, how are they supported?
l. What is the organizational relationship between the various levels of the organization?
m. What are your top three (3) operational challenges?

D.2 Interview questions for ASB Policy Centre's personnel

a. Describe the operational ownership of each of the stations (federal or under contract)
b. What are the needs for the services in each of the regions?
c. Describe the channels of communication between HQ and bases
d. Describe any initiatives currently being implemented to improve operational and maintenance activities
e. Functioning of the AMO and relationship with the bases
f. Describe any systems in place to monitor, track and dispatch maintenance and operational activities

g. Describe any performance metrics that may be in place to measure any of the activities involved delivering air services to Canadians
h. Describe the RCMP's current procurement strategy for replacement aircraft (new used, etc.)?
i. What are forecasted budgets for the next five years (NP, Maintenance and Overhaul)?
j. Are there any environmental considerations in the selection of replacement aircraft?
k. Are bases staffs involved in the procurement of replacement aircraft?

D.3 Interview questions for other RCMP Policy Centre's personnel

a. Describe your operation.
b. How do operations different between the various provinces?
c. Do you have a say in how your services are provided within a specific province?
d. How much do you rely on ASB to fulfil the objectives of your organization?
e. What is the role and importance of Air Services to support your part of the operation?
f. How do you use ASB resources?
g. What would you estimate the percentage of times to be when you call for air service and the aircraft is not available?
h. Are the available resources suitable to your needs?
i. Are there any requirements not being met? If so which ones?
j. What would need to support those requirements?
k. Considering the financial limitations of the RCMP based on government funding, is the service provided commensurate with the available resources?
l. Given the above, it implies there may be a need to prioritize and choose services ASB can provide. If you had to choose, what part of your mandate would you agree to use alternative means to fulfill your mandate?
m. Are there alternatives to the ASB to support your mandate?
n. Has there been any study performed to examine those alternatives?

Annex E - List of personnel consulted during the study

During the study, it was required to meet with a number of RCMP members to understand the needs and roles of each of the Air Sections as well as the internal clients. The results of those interviews were subsequently validated against actual data and sources of information to determine the magnitude of the concerns and to propose potential solutions. The following table provides a list of personnel interviewed and their role within the organization. The list of personnel identified was done in consultation with ASB policy Centre personnel.

To note, an interview with Transport Canada Aircraft Services Directorate was conducted to examine their maintenance and operations' practices.

RCMP ASB and Fleet Strategy - Interviews				
Position	**Title**	**Name**	**In person**	**On the Phone**
Air Services Branch Policy Centre - Ottawa				
Assistant Commissioner Technical Operations	Assistant Commissioner	Joseph Oliver	X	
Director General Air Services Branch	Chief Superintendent	Luisa Lemay-Russo	X	
DG Assets Management & Programs	Civilian	Milton Jardine	X	
National Manager Moveable Assets	Civilian	Julie Furlotte	X	
Director of Maintenance	Civilian	Bruno Thuot	X	
Rotary Wing Chief Pilot	Civilian	Jacques Girard	X	
Fixed Wing Chief Pilot	Civilian	Gary Hartery	X	
Acting ASB Aviation Safety Program Manager	Civilian	Marc Fouasse	X	
SOCC Manager	Civilian	Kristine Feraco	X	
Air Services Branch - Divisions				
C Division - Quebec				
Base Manager	Civilian	Eric Bolduc	X	
Helicopter Pilot	Civilian	Yvon Veilleux	X	
Aircraft Maintenance Engineer	Civilian	Richard Lafrance	X	
Aerial Surveillance Coordinator	Corporal	Sylvain Aubry	X	
D Division - Manitoba				
Division Support Services Officer	Superintendent	John Duff	X	

RCMP ASB and Fleet Strategy - Interviews				
Position	**Title**	**Name**	**In person**	**On the Phone**
Base manager	Civilian	Robert Norman	X	
E Division - British Columbia				
Division Deputy Criminal Operations Specialized Investigative and Operations Officer	Chief Superintendent	Brian Cantera	X	
Officer In Charge Support Services	Superintendent	Gary Shinkaruk	X	
Officer In Charge E Division Air Services	Inspector	Nigel Bushe	X	
Tactical Flight Officer Supervisor (Boundary Bay)	Corporal	Curtiss Brassington	X	
Helicopter Pilot Supervisor (Boundary Bay)	Corporal	Roger Thomson	X	
Vancouver Air Section Base Manager (Langley)	Civilian	Jonathan Glover	X	
Pilot (Prince Rupert)	Civilian	Eric Rempel		X
Base Helicopter Pilot (Prince George)	Civilian	Paul Beaudry	X	
Base AME (Prince George)	Civilian	Larry Zenzen	X	
F Division - Saskatchewan				
District Commander	Superintendent	Grant St-Germain		X
	Superintendent	Rob Cameron		X
Pilot	Civilian	Martin Dolny		X
Administration	Civilian	Wendy St-Germain		X
G Division - Northwest Territories				
Criminal Operations Officer	Superintendent	Mike Lesage		X
NCO i/c Contract Policing	Staff Sargeant	Bruce McGregor		X
Senior Pilot	Civilian	Adam Van Dusen		X
H, J, L & B Division - Atlantic Air Services				
Officer in Charge Atlantic Region Air Services	Inspector	Dave Mazerolle	X	
Helicopter Pilot I/C	S/Sgt	Scott Healey	X	
Helicopter Pilot	Civilian	Larry Labadie	X	

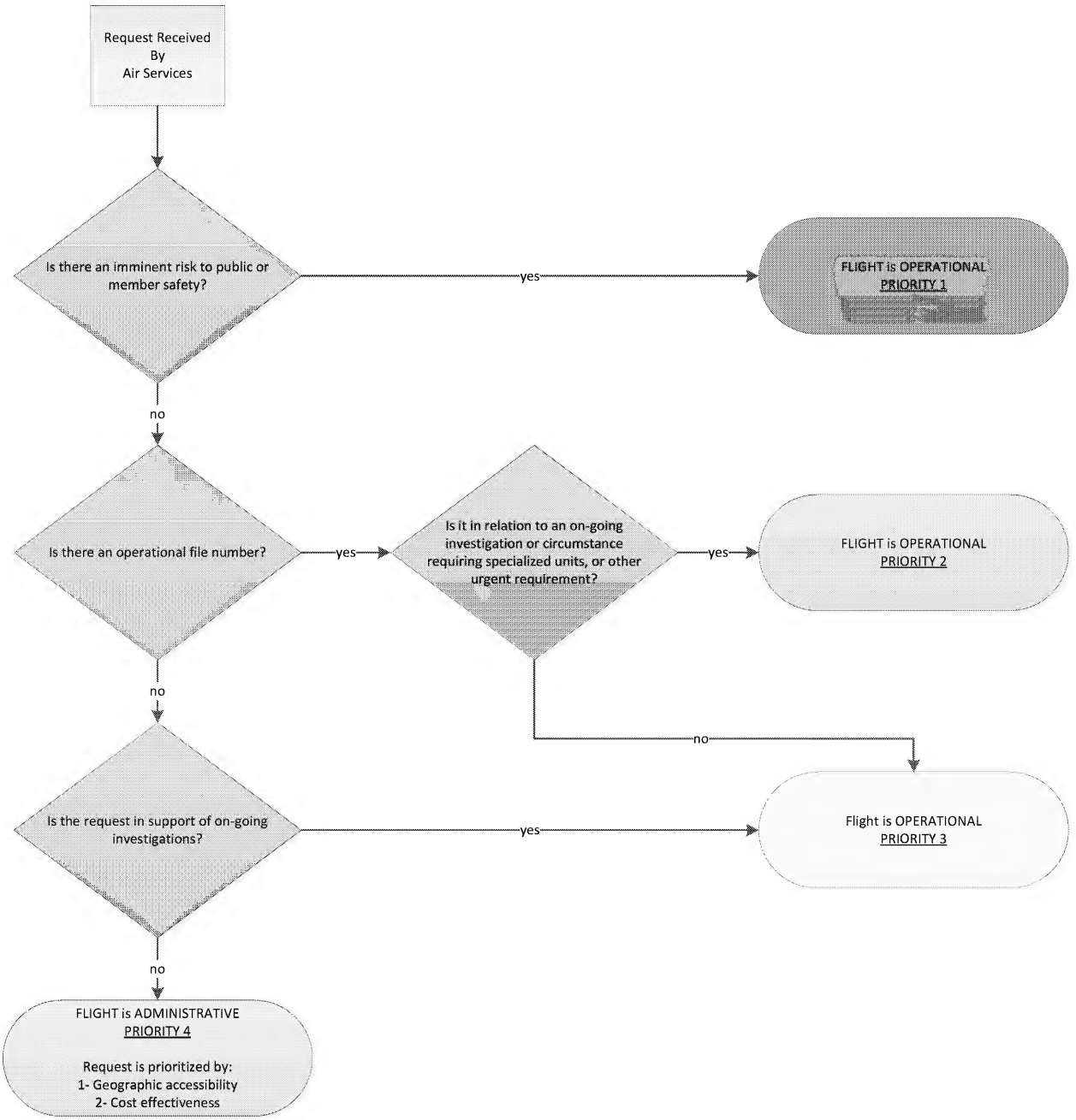
RCMP ASB and Fleet Strategy - Interviews				
Position	**Title**	**Name**	**In person**	**On the Phone**
Officer in charge of Detachement (Goose Bay)	Inspector	Tony Perry		X
Senior Pilot (Goose Bay)	Civilian	Wayne Windsor		X
K Division - Alberta				
Officer in charge of Support Services	Inspector	Gary Graham	X	
Base Manager Edmonton Air Section	Civilian	Mark Hovdestad	X	
Senior Fixed Wing Pilot	Staff Sargeant	Jerry Klammer	X	
Tactical Flight Officer	Constable	William Appleby	X	
Aircraft Maintenance Engineer	Civilian	Richard Giles	X	
M Division - Yukon Territory				
District Commander	Inspector	Dan Austin		X
District Advisory NCO	Staff Sargeant	Brad Kaeding		X
Ottawa Air Section - Ontario				
Acting Base Manager	Civilian	Paul McInnis	X	
V Division - Nunavut				
Operations Support Services Officer	Inspector	Dean Warr	X	
Base Manager Air Section	Civilian	Colin Gunn	X	
RCMP Policy Centre - Clients				
DG, Operational Readiness and Response (ERT, Critical Incident, etc.)	Chief Superintendent	Ross White	X	
Protective and Criminal Operations Officer	Chief Superintendent	Bruce Kirkpatrick	X	
DG Technical Investigation Services	Chief Superintendent	Jeff Adam	X	
Witness Protection	Staff Sargeant	John Tereposky		X
Other organizations of interest				
DG Aircraft Services (Transport Canada)	Civilian	Gerald Toupin	X	
WinAir (Maintenance Software)		Bert Vergeer	X	
WinAir (Maintenance Software)		Charlotte Kruger	X	

Annex F - Air Services Flight Priority Matrix

Within the last two (2) years, the Air Services Branch has developed a priority matrix to ensure the best use of the available assets and to concentrate support to direct RCMP operations.
The following has been provided by the RCMP and is being used by the Air Services Bases in assigning resources.
All RCMP Air Services flights are related to police operations. Within that scope, some flights will be deemed operational while others as administrative police travel. The goal of this document is to provide a guideline in determining the appropriate flight priority of incoming requests.

Priority 1 - Active imminent risk to a member and/or public safety.
Priority 2 - Possible risk to a member and/or public safety.
Priority 3 - Operational support and/or response.
Priority 4 - Those requests that ***do not*** meet the above-noted requirements, but support the organizational mandate for example; internal audit, training, finance, property management.

The following figure provides a logical analysis process to establish flight priority.



Annex G – ERT Statement of Requirements for ASB services

An internal analysis was performed by CIP and ERT management to determine airborne support needs for their missions. The following provides details of a SOR that was prepared by the National ERT Program for the Contract Aboriginal Policing Directorate.

G.1 Key ERT Air Support Mission Analysis

ERT utilizes the following air support capabilities:

Airlift

a. Transporting an ERT (personnel and equipment) from their home location to the incident location.
b. Insertion of operators from a holding area into the area of operations (AOR).
c. Movement from point A to B within the AOR.
d. Security over-watch and deployment of a Quick Reaction Force (QRF).
e. Medical evacuations.
f. Re-supply in austere environments.

Intelligence, Surveillance, Reconnaissance (ISR)

a. ISR is the coordinated and integrated acquisition, processing and provision of timely, accurate, relevant, coherent and assured information and intelligence to support the conduct of activities.
b. ERT uses Aircraft ISR to conduct aerial surveys, search activities, monitoring situations, terrain analysis

Unmanned Aerial Systems (UAS)

Tactical level aerial ISR support for on-scene support to ground troops.

Command Post Support

a. ERT operates under the command and control of a Critical Incident Commander (CIC) who regularly is positioned forward in a command post located near the area of operation.
b. Air Services Branch Command Post Liaison, upon request, provides support and is responsive to the CIC and the mission to understand and coordinate air services assets employed in the area of operation.

G.2 REQUIREMENTS

The requirements listed by the ERT are listed for both RW and FW aircraft. They were provided in three categories:

a. Immediate: Existing capabilities or capabilities that can be deployed without delays;
b. Intermediate: Capabilities that require approvals, R & D, policy, SOP and training development to implement.
c. Future: Capabilities that do not currently exist, but that could be developed is RCMP executive had the appetite to develop and implement.

Only Immediate and intermediate capabilities requirements are being presented in this Annex. Some of the capabilities anticipated by the RCMP in the future category are presently mostly performed by the military.

AIRLIFT – ROTARY WING

Immediate - Capabilities that ERT can begin implementing without delay.

PAX Capacity

a. Optimum: 7 ERT members fully kitted and a Police Dog.
b. Represents our minimum number of operators (6), and a PDS Team to conduct a direct action/QRF response.
c. Represents a "cutoff team" used in apprehending suspects is a rural man hunting operation.
d. Provides space to conduct prisoner escorts with security from remote, austere locations.
e. Provides the room for stretcher medevacs with attendants.

Lift Capacity

a. Minimum: 2500lbs
b. Average weight of a fully kitted ERT operator is 250lbs, plus equipment and a Police dog 100lbs.
c. 7(pax) x 250lbs=1750lbs+100lbs(Dog)=1850lbs+(7 (bags)x50lbs)=2200lbs + 300lbs safety factor= 2500lbs

Capacity to transport in the cabin

An injured person in a litter and room enough for two medics to monitor and tend to the patient while enroute to advance medical care.

Tyler Special Operations Platforms (TSOP)

a. Racks mounted externally to transport, insert and extract two-four ERT members quickly.
b. Required to minimize the amount of time on the ground that a helicopter is open to a ground attack from adversaries. (20 seconds vs 1-2 minutes).

Time on Station

a. Fully loaded with pax/equipment: Min. 60 minutes, Optimum 90+ minutes.
b. This is to provide ISR and/or force adversaries to ground to allow the ground forces to safely catch and apprehend suspects.
c. ERT is mandated to conduct operations off both coasts, The Great Lakes and in and around the many large bodies of water throughout Canada.
d. Required to provide ISR, over-watch and insertion and extraction for operations and medevacs over water.

Capable of operating over a marine environment

a. Range: 50 Nautical Miles with 60 minutes of loiter time.
b. Represents the time to complete a mission during a cycle of darkness, which is the optimum time and best chance of success for tactical operations, land or at sea.
c. Represents the distance required to conduct operations and safeguard the entry points to the Juan de Fuca Strait on the West Coast.
d. This represents the safe distance to project force away from built up or sensitive areas of population for consequence management and contingency planning. (E.g. protecting the public from any type of CBRNE threats.)

Human External Transport System (HETS)

a. Long Lining below a helicopter
b. Required for medical evacuations and insertion/extraction of personnel and equipment in remote locations, rough terrain and where the tree canopy prevents landing.

Capable of conducting night operations on NVGs

a. Compatible dashboard gauges and internal/external markings
b. Required to safeguard the crew and PAX from being identified by adversaries.

ISR Capabilities

a. Recordable day/night camera, Thermal, Night Vision, white light, IR Flood and Pointer for navigation, SAR, locating suspects and identification to ground forces.
b. Moving maps for urban navigation and identification of points of reference for ground forces.
c. ERT Radio Communication for air crew to monitor and speak directly to ground forces.
d. Downlink capability to transmit imagery directly to Command Posts and ground forces.

Intermediate - Capabilities that require approvals, R & D, policy, SOP and training development to implement.

Rope Insertion/Extraction

The ability to rapidly deploy ERT members into locations where a helicopter cannot land.

Rappel

The ability to deploy 4-6 ERT members in harnesses from a hover position down ropes on all at once. Can be used for extraction as well. Advantageous for insertions of longer distances or with heavy loads.

Fast-rope

The ability to deploy ERT members down single thick rope (like sliding down a fire pole), mounted on each side of the platform without harnesses. Much faster than rappelling and eliminates the risk of getting caught up in ropes, time spent unhooking from the descending device and allows members to immediately apply force if needed to defend themselves or the public. Several members can slide down at the same time for quicker deployments.

AIRLIFT – FIXED WING

Strategic Airlift for transportation to the area of operation

e. PAX 15 (12 operators + 3 supporters)

- This represents a single ERT/CIP deployment package.

f. Weight 4500-5000 pounds (250lbs/members + 50lbs operational equipment each)
g. Luggage dimension 15 bags/cases 40"L x 14"W x 12"H.
h. Range as per fig.2.
i. Airstrip/Landing zones as per current locations serviced by air services.
j. Dangerous Goods – These are operational items used by ERT.

- Ammunition – Handgun (9mm), Carbine (.556, 300Blk), Rifle (308, 338)
- Noise Flash Diversion Devices
- Chemical Munitions (OC Spray, CS Gas, CS Powder, Smoke)

b. Explosive Forced Entry Fly Away Kit (Details as per CBRNE Operations Unit and are composed of: Door charges, Pen Flares and Det Cord)

Tactical Air ISR Support in the area of operation.

a. High Resolution Daytime Camera*
b. High Resolution Thermal Camera * – To detect heat signatures day and night.
c. Infrared Illuminators (flood) – To light up a search area at night that can only be seen with night vision.
d. Infrared Pointers – To pin point a specific location from the air to ground forces using night vision.
e. Moving Maps - For urban navigation and identification of points of reference for ground forces.
f. Communication (Radio) to Command Post and ground forces for air crew to monitor and speak directly to ground forces.

* Imagery from aircraft must have downlink capability and transmittable through IP addresses to the Command Post and ground forces using personal end user devices (Smart phones, tablets, computers) and be recordable for evidentiary purposes.

Annex H – Similar aircraft comparisons

This annex provides technical comparisons between aircraft of similar capacity to perform the roles assigned to ASB. The data used is from independent sources and is presented in a similar fashion for each aircraft type. The numbers are used to provide a picture of the options and to objectively make the best comparison exercise. Some of the data may be missing as it was not available. The figures are used for comparison purposes and presented under the same assumptions. For instance, the actual purchase price of an aircraft may be more or less depending on the options selected and the negotiations that take place. One of the sources for the information provided is the Conklin & de Decker Aviation Information – Aircraft Cost Evaluator 2016.

Specifications	Transport Aircraft				Surveillance Aircraft/Small Transport					Others		Helicopters				
Make	PC12 NG	King Air 350ER	Dash -8 (100)		Cessna T206H	Cessna 208B	Diamond DA62 MPP	Quest Kodiak		DHC6-300		EC120B	AS350	EC135T2 Twin Engine	EC145 Twin Engine	Bell 429 Twin Engine
Fuel Type	Jet	Jet	Jet		Avgas	Jet	Jet	Jet		Jet		Jet	Jet	Jet	Jet	Jet
MTOW (lbs)	10,450	16,500	36,300		3,600	8,750	5,071	7,255		12,500		3,781	4,960	6,250	7,904	7,000
Max Range (Nm) (no payload)	1,635	2,678			703	1,163	1,283	1,132		775		395	362	332	370	368
Ferry Range (seats full) (Nm)	1,309	2,400			387	529	827	524		356		240	300	332	370	368
Standard Useful Load (lbs)		6,880	8,407		1,255	4,271	1,609	3,535		5,085		1,598	2,224	3,208	3,953	2,535
Crew/Passenger seats	1 + 9	1 + 9	2 + 37		1 + 5	1 + 9	1 + 6	1 + 9		1 + 19		1 + 4	1 + 6	1 + 6	1 + 9	1 + 7
Cruise Speed-Max (KTAS)	240	303	159		178	184	190	183		170		150	155	140	145	155
Service ceiling (ft)	30,000	35,000			27,000	23,700	20,000	25,000		25,000						
Rate of Climb (Ft./Min)	1,920	2,979			1,050	975	1,029	1,371		1,600						
T/O Distance (ft)	2,600	4,057			1,740	2,420	2,897	1,468		STOL						
Price New (USD)	2,600,000	7,500,000	N/A		738,000	2,600,000	1,080,000	1,975,000		7,000,000		1,900,000	2,600,000	5,500,000	6,900,000	7,100,000
Operating cost per hour (USD)	714	1,178			N/A	508	N/A	491		N/A		456	617	817	1,135	883
- fuel burn - liters per fl.hr	265	480			59	200	45	185		350		136	200	242	300	210
Cost per satute mile (USD/mile)	2.41	3.37			N/A	2.69	N/A	2.84		N/A		3.13	3.55	5.61	6.29	5.18
Maintenance hour/Flight Hour	0.65	0.82			N/A	0.47	N/A	0.47		1.10		0.88	1.10	1.32	1.70	1.28
Major Life limits (hrs or years)	20000 hrs	Nil	Nil		Nil	Nil	Nil	Nil		Nil						
Cabin Height (inches) [1]	58	57			49.5	51	50	57		59						
Cabin Width (inches)	60	54			44	62	49	54		69						
Cabin Length (feet/inches)	16' 11"	19' 6"			12' 1"	21' 4"	9' 5"	15' 10"		18' 5"						

Note: Above data is for current production aircraft except Dash 8-100 and DHC6-300 which are no longer in production.

(1) Manufacturers do not specify where these measurements are taken

Annex I - Environmental consideration

This annex addresses two environmental considerations that affect aviation and major aviation operators. The first one is the Avgas LL100 fuel replacement program that will be removed due to environmental considerations and the other one being the pledge made by the federal government to reduce gas emissions for itself and for the industry.

Although not an overriding factor in their decision-making, the RCMP, as a federal government organization, needs to consider these environmental considerations as pressures have been put on the commercial aviation industry in the country to take actions and reduce gas emissions.

I.1 FAA's Piston Aviation Fuels Initiative

The Piston Aviation Fuel Initiative (PAFI) was established in 2013 at the request of a broad cross section of the aviation and petroleum industries, along with consumer representatives, to develop a path forward for the identification, evaluation and deployment of the most promising unleaded replacements for 100 low lead aviation gasoline (100 LL Avgas).

Avgas is the only remaining lead-containing transportation fuel. While it prevents damaging engine knock or detonation likely to result in a sudden engine failure, lead in Avgas is also a toxic substance with high environmental and even health impacts - leaded aviation gasoline was linked in a 2011 study to high level of metal toxicity in the body of children who live in proximity of general aviation airports. With more than 167,000 piston-engine aircraft relying on this type of fuel, Avgas emissions have become the largest contributor of lead fuel emissions in the United States.

Under the Piston Aviation Fuel Initiative (PAFI), the Federal Aviation Administration (FAA) is partnering with the Environmental Protection Agency (EPA) and the industry to research unleaded fuel solutions. More specifically, the mission of the PAFI is to evaluate unleaded replacement fuel candidates and identify the best alternative options that technically satisfy the needs of the existing aircraft fleet and effectively respond to supply and demand considerations such as production capacity, distribution network, total cost, availability of the resource as well minimizing environmental and health impacts. .

Since 2013, the FAA has supported and coordinated research of alternate fuels at the William J. Hughes Technical Center, in Atlantic City and here are some of the achieved milestones:

- In June, 2013, the FAA issued a request for candidate fuel producers to submit unleaded fuel formulations to be evaluated as replacements for 100LL
- In July 2014, the FAA receives nine fuel proposals from five fuel producers: Afton Chemical Company, Avgas LLC, Shell, Swift Fuels, and a consortium of BP, TOTAL, and Hjelmco.
- In September 2014, the FAA selects 4 fuels: one each from Shell and TOTAL, and two from Swift Fuels.
- In March 2015, Phase 1 laboratory and rig test program begins.
- On March 29, 2016, the FAA selects 2 unleaded fuels for Engine and Aircraft Testing on approximately 15 engine and 10 aircraft models. The two formulations were selected as likely to have the least impact on the General Aviation fleet based on a Phase 1 review of

an extensive set of data along with updated Feasibility Assessments that was submitted by each fuel provider. The Phase 2 engine and aircraft test program is expected to take approximately two years, and will generate data that can be used to authorize most, if not all, of the existing fleet to operate on these fuels. This data will also be used to obtain an ASTM International production specification.

At this time, the competitiveness of the future replacement fuels is highly uncertain. The only certainty is that the days of 100LL aviation gasoline powering the general aviation fleet are numbered. The ongoing process will result in the introduction of new standards for the GA fleet. Faced with uncertainty, an increasing number of GA aircraft are being designed around long-time neglected diesel engine concepts, while other might turn to more electric aircraft technology.

I.2 Environmental Regulations

ICAO

Since 1977, the International Civil Aviation Organization (ICAO) has promulgated international emissions and noise standards for aircraft and aircraft engines that apply to all member states. ICAO, through its Committee on Aviation Environmental Protection (CAEP), has reviewed and revised these standards when warranted and has developed operational policies and procedures to mitigate further the environmental impacts of civil aviation.

The General Aviation Manufacturers Association (GAMA) and the International Business Aviation Council (IBAC), on behalf of the manufacturers and operators of business and general aviation worldwide, decided they would join with the commercial aviation sector in endorsing the International Civil Aviation Organization's (ICAO) proposal for a global sectoral approach for aviation emissions in a post-Kyoto agreement on climate change. They have therefore defined the following targets:

- Carbon neutral growth by 2020;
- An improvement in fuel efficiency of an average of 2% per year from today until 2020; and
- A reduction in total CO2 emissions by 50% by 2050 from 2005.

Transport Canada

Transport Canada is the Canadian aviation regulatory body for air transport and a full-fledged member of the ICAO committee that deliberated to reach the prescribed environmental standards that are addressed in this Annex.

Since 2008, ICAO has put in place standards for reducing greenhouse gas emissions as well as aircraft generated noise levels. The work led to the actual results, and the ones of subsequent work conducted by the Committee on Aviation Environmental Protection (CAEP). In October 2010, the International Civil Aviation Organization (ICAO) adopted a new Assembly Resolution on climate change (A37-19) defining multi voluntary goals. To support ICAO, its members were encouraged to present an action plan before June 2012.

In 2012, building on work done by ICAO and the success of the world's first voluntary agreement to reduce greenhouse gas emissions from aviation, the Government of Canada and the Aerospace

Industries Association of Canada (AIAC) have developed Canada's Action Plan to reduce greenhouse gas emissions from aviation (The Action Plan). The Action Plan was co-signed by the following organizations:

Aerospace Industries Association of Canada (AIAC), Air Transport Association of Canada (ATAC), Canadian Airports Council (CAC), Canadian Business Aviation Association (CBAA), National Airlines Council of Canada (NACC) and Nav Canada.

The fundamental principle of the Action Plan is that Transport Canada recognized that while air travel supports Canada's economy, trade and tourism, and connects Canadians separated by great distances and rugged terrain, it also contributes to greenhouse gas emissions. This is why the action plan developed by Transport Canada, in collaboration with its co-signatories, is a voluntary plan where the parties express how, in good faith, they intend to reduce greenhouse gases from aviation. This voluntary Action Plan expresses how the parties, in good faith, intend to reduce greenhouse gas emissions from aviation activities. The Action Plan does not contain legal obligations of any kind or impose unreasonable expectations on any party, or intend to negatively impact any air carrier's ability to do business in Canada.

In line with the broad international consensus, the Action Plan sets an aspirational goal to improve fuel efficiency from a 2005 baseline by an average annual rate of at least 2 percent per year until 2020. To reach this goal, the Action Plan identifies three key measures that are expected to have the greatest environmental impact:

a. Fleet Renewals and Upgrades;
b. More Efficient Air Operations; and
c. Improved Capabilities in Air Traffic Management.

The Action Plan is a living document that will evolve through semi-annual meetings between government officials and the Canadian aviation industry, annual reporting on the progress towards achievement of the Action Plan's fuel efficiency target, a review of the Action Plan, that will occur in three years and an audit that will occur at least once over the next five years. The last annual report is dated 2014.

In order to reduce GHG emissions from Canada's aviation sector, Canada has set a target of an average annual improvement in aviation fuel efficiency of at least 2 percent per year until 2020 (from a 2005 baseline, measured in litres of fuel per Revenue Tonne Kilometre (RTK)).

The industry has put in place a number of initiatives to support Canada's efforts to meet these national objectives:

a. Increase the fuel efficiency of the Canadian aircraft fleet and its operations (Major Canadian airlines modernized their fleets);
b. Improve the efficiency of Canada's air traffic management system (Nav Canada has made significant progress towards adopting performance-based navigation (PBN); and
c. Modernize airport facilities (Canadian airports are using more renewable energy sources).

The measures detailed below will help Canada achieve the fuel efficiency target. The Action Plan proposes a number of measures to be implemented. So there are direct measures under the responsibility of the industry.

Direct Measures

a. **Fleet Renewals and Upgrades**
In response to this measure, members of the National Airlines Council of Canada (NACC) started to modernize their fleet with more recent aircraft meeting the environmental norms. The Canadian Business Aviation Association (CBAA) will encourage its members to take advantage of opportunities to reduce GHG emissions through fleet renewal.

b. **More Efficient Air Operations.** Canadian airlines put in place procedures to achieve an average annual fuel efficiency improvement of 0.2 percent for both domestic and international flights between 2005 and 2020 through improved operations. Moreover, ATAC will encourage their members to continue to take advantage of the opportunities presented in the new ICAO manual – circular 303.

c. **Improved Capabilities in Air Traffic Management.** Performance-based Navigation (PBN) — shifting from sensor-based to performance-based navigation will enable more efficient enroute and airport operations for equipped aircraft, reducing fuel burned and associated GHG emissions. Building on existing PBN activities, further implementation could improve average annual fuel efficiency by 1 to 2 percent between 2005 and 2020. Transport Canada and Nav Canada will work in partnership to support Canada's PBN Plan.

Annex J – Taskings Coordination and Operational Centres - Options Analysis

The analysis was performed assuming three (3) potential options:

d. Status Quo;
e. Regional Operational Centres; and
f. National Operational Centre

The following tables provide the "Pros" and "Cons" for each of the models.

J.1 OPTION 1: STATUS QUO

PROS	CONS
Maintain direct communication with local user/client (Divisions)	Difficulty in formalizing tasking requests: info/data
Maintain current response capability	Less optimised to share resources: A/C, people, parts, data
Direct local oversight of operations	Metrics and data likely need to be pushed to Policy Centre (no real time centralised data)
Policy Centre requires regular visits /audits on site to perform and validate: - Standardization; - Compliance evaluation; and - Implementation of changes: automation, reporting, planning, etc.…	Risk that changes are not readily implemented and information is not readily shared especially on operations and safety issues.
- Standardization	People are likely to develop local, not integrated system/process workarounds instead of correcting the process.

J.2 Option 2: Regional Operational Centres (4 or 5 regions)

PROS	CONS
Better visibility of regional resources (a/c, people, parts, etc.....).	Some changes in direct contact with users/clients.
Less data gathering points for reporting.	Regional centres likely to push data to Policy Center.
Less sites for Policy Centre to supervise (regional accountability).	Still some risk of operational/safety issues not shared around network of Air Sections.
Less sites and functions to automate (scheduling, maintenance, etc.....).	Change management concerns.
Potential economies of scale with shared resources (management, flight coordination, etc.).	

J.3 OPTION 3: National Operation Centres and local detachment bases

PROS	CONS
Optimal operational control and visibility of resources: A/C, people, parts, etc.....	Perception of loss of local contacts for clients/users
24 hour operations centre (call centre)	Perception of response time capability
Optimal data gathering for operations metrics	Serious change management issues
Optimisation of PFM or other platform	Requirements for local audits required
Immediate performance metrics (real time)	Risk of remaining Central Canada centric
Metrics are pushed to Air Sections	
Optimise maintenance Master Planning	
Potential economies of scale	
Optimize operational and safety data sharing	

Annex K - Dash 8 Multi-Role Transport Aircraft

FIELD AVIATION

Field Aviation
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Hangar 2
Mississauga, Ontario
Canada L5S 1B2
Phone: + 1 905 678 1540
Fax: +1 905 676 0977
www.fieldav.com

Field Aviation Feasibility Proposal

To

Royal Canadian Mounted Police

For

The Lease of two DHC-8 300 Multi-Role Aircraft

Date:	Date - June 30, 2016
Budgetary Proposal No.:	16-124
Revision:	IR

Diamond AIRCRAFT

Explorer Solutions

1494, rue Montarville, Suite 205
Saint-Bruno-de-Montarville, PQ
J3V 3T5

DA62 Proposal

Twin Engine Safety with Single Engine Operating Costs